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# Monthly Message

On Christmas Day 1958 an editorial entitled, "War Against Disease" appeared in the *Washington Post and Times Herald.* Aid in the form of public health, preventive medicine, and veterinary measures are only part of a medical aid program, important though they may be. There are three other directions for medical aid that should not be forgotten:

The first is direct assistance in the form of hospitals and health clinics together with visiting personnel on short or long tours, either for work in medical schools or to help in the establishment of these clinics.

The second is proper education and assurance of opportunities for learning for the group of selected students who come to this country for postgraduate education.

And the third, as noted in the editorial, is the restoration of medical libraries in various Asian countries: "Many such libraries were destroyed in World War II and have not been replaced. This great handicap upon the medical schools and practitioners could be overcome without heavy expense. There are also acute needs for technical aid in medicine, for hospitals, drugs and medical supplies."

The language of the medical schools in most of these countries is English. Therefore any books, periodicals, or old files of our journals will be greatly welcomed either by individual friends, or by medical schools, hospitals, and medical libraries in these countries.

Frank B. Berry

FRANK B. BERRY, M. D.
Assistant Secretary of Defense
(Health and Medical)

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UNITED STATES ARMED FORCES MEDICAL JOURNAL

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# A MOUTH-TO-MASK RESUSCITATION DEVICE

HENRY W. SEELER, M. E.

UNDER the auspices of the Army Chemical Center, a number of medical authorities[1-4] in the field of artificial respiration completed an investigation program in which they compared the efficiency of the traditional manual resuscitation methods with mouth-to-mouth resuscitation. The result was highly in favor of the mouth-to-mouth method, with lung-ventilation rates far in excess of those obtained with manual resuscitation methods. There can be no doubt that the results of this investigation are correct. If the ventilation rate with manual resuscitation by trained personnel is so low, however, what will it be if an untrained layman must work on a patient? It would be interesting to find out how many people in hospitals, first-aid stations, factories, and on the street are trained or able to give manual resuscitation. It is strongly believed that the percentage is very low. Most accidents happen where no highly trained person such as an anesthetist is at hand. Resuscitation must be applied within seconds, but by whom and how?

## OBJECTIONS TO MOUTH-TO-MOUTH RESUSCITATION

The idea of mouth-to-mouth resuscitation is actually centuries old. Except for a possible implication of a bona fide resurrection, it is cited in the Old Testament, II Kings.[5] Mouth-to-mouth resuscitation, because of its high efficiency and simple application, may provide a much better method for common use. The greatest obstacle in applying this method may be appre-

From Aero Medical Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.

Presented on 29 April 1959 at the thirtieth annual meeting of the Aero Medical Association, Los Angeles, Calif.

hension on the part of the operator to put his lips full upon the lips of a drowned casualty whose lips may be covered with mud or who may already be dead. If a family member is the casualty, the mouth-to-mouth method may be less objectionable. In any case, the mouth-to-mouth technic should be initiated immediately; therefore, the procedure should be made known to everybody. A clean handkerchief between the lips of victim and operator may overcome this objection.

Is apprehension the only objectionable factor against applying direct mouth-to-mouth resuscitation? The casualty's breath directly on the operator's face or even in his mouth would be another factor, but the main objection will be the dizziness of the operator after a short time of applying resuscitation. This dizziness will be caused by hyperventilation from his continuous deep breathing. If apprehension as well as hyperventilation of the operator could be overcome by some practical means mouth-to-mouth resuscitation, with its high ventilation rate, would be the ideal method for first-aid resuscitation. Fully aware of these facts, this laboratory designed in succession two models of mouth-to-mask resuscitation devices that have been classed intermediately between straight mouth-to-mouth and automatic resuscitation methods. The latest design that is described here is a simple, foolproof, and complete mouth-to-mask resuscitation device that will overcome the drawbacks of the mouth-to-mouth method. The control valve and associated tubing employ engineering and physiologic design principles that direct the subject's exhalations away from the operator, and permit prolonged cyclic ventilation without exposing the operator to the effects of hyperventilation. The design could be adapted to any mouth-to-airway or mask-to-mask resuscitation system. It can be used in normal rescue situations and has been adapted for use with appropriate filters to protect the operator and subject in contaminated atmospheres.

## THE RESUSCITATION DEVICE

The diagram of the complete mouth-to-mask resuscitation device is shown in figure 1. According to research conducted by the Army Chemical Center, the dead air space for the operator should be fixed at 300 ml to maintain a normal carbon dioxide pressure (tension) ($pCO_2$) in the alveolar air. This will avoid hyperventilation of the operator. The basic part of the whole system is a simple control valve shown in the center of figure 1. This valve consists of three parts: a lower and an upper valve housing interposed by a specially formed or flat diaphragm. The parts can be joined together permanently because no repairs will be necessary, especially if the diaphragm is of silicone rubber. With silicone rubber, the complete valve can be cleansed

and sterilized repeatedly without taking the unit apart. A quadruple flapper, shown above the valve parts in the center of figure 1, is inserted into a groove in the upper valve housing and serves as the inhalation valve for the operator.

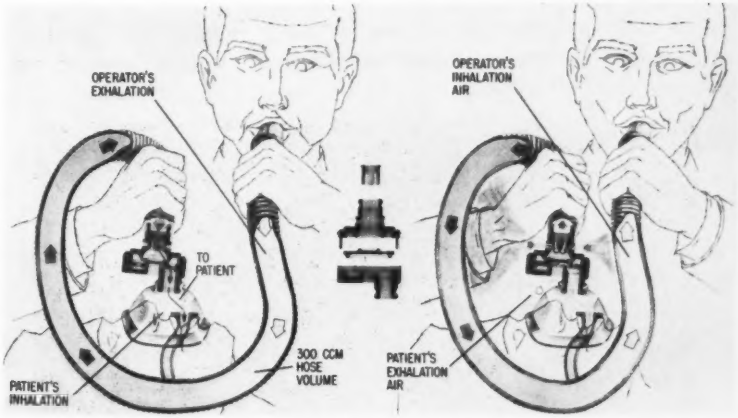


*Figure 1. Diagram of mouth-to-mask resuscitation device.*

The illustration on the left of figure 1 shows the patient's inhalation phase. After inserting the proper airway into the trachea and positioning his jaw forward, the mask will be put on the patient's face. The operator first blows the hose content of 300 ml of fresh air into the patient's lung. After that, his exhalation air will follow. While the operator is blowing air, the diaphragm will move away from the upper valve seat and allow the air to rush freely through multiple holes in the diaphragm through the lower valve housing and mask into the patient's lungs. Simultaneously, the diaphragm will be pressed onto the lower valve-housing seat which closes the exhalation port for the patient.

At the end of the operator's exhalation, see right-hand illustration in figure 1, the air pressure in the hose drops to zero, and the higher air pressure in the patient and mask initiate the patient's exhalation phase and closes the upper valve seat. This action blocks the air flow back into the hose and, simultaneously, opens the lower valve and exhalation port to allow the patient to exhale freely. During the patient's exhalation, caused by the air pressure in his breathing system, the operator starts to inhale. He does not inhale through his nose but through the mouthpiece drawing the initial gas content of 300 ml of his own previously exhaled air from the hose followed by fresh, outside air that enters through four holes in the upper valve

housing. These holes are normally closed by the quadruple elastic flappers. In the last part of the operator's inhalation phase, he will be drawing in sufficient air to finish filling his lungs to replace the air in the hose with fresh air to be used by the patient during the next inhalation phase. These cycles, inhalation-exhalation, can be repeated over a long resuscitation period during which the operator never inhales the patient's exhalation air. He will not be repelled by apprehension and will not hyperventilate.

*Figure 2. Demonstration of experimental mouth-to-mask resuscitator kit in use.*

Figure 2 shows an experimental mouth-to-mask resuscitator kit as it would be used on a person rescued from drowning. The kit consists of an airway hose with mouthpiece, the main breathing-control valve, and the patient's mask. A bulb-actuated aspirator is not shown in this illustration.

## USE IN CONTAMINATED ATMOSPHERE

There follows explanation of the use of the same breathing control valve put into a mask-to-mask resuscitator kit for use in a contaminated atmosphere (fig. 3). The function is basically the same as described before. The operator, who wears a stand-

ard, unmodified gas mask, inhales through a 300-ml hose with a standard gas filter attached to its other end. Temporarily, the hose is clamped onto the gas mask exhalation-valve outlet. The exhalation valve itself is opened temporarily with two extensions from the inside which are a part of a temporarily inserted mouthpiece for the operator. The mask for the patient is fastened on the breathing-control valve. When the operator exhales, he blows through the hose and control valve into the

*Figure 3. The mask-to-mask resuscitator kit for use in a contaminated atmosphere.*

patient. Excess air during this phase is vented through the mask exhalation valve. The patient exhales in the same manner as described before, except that his exhalation port has an exhalation flapper valve that prevents contaminated air from entering the system after he starts to breathe by himself. The patient also inhales through a standard gas filter located close to the control valve. The operator can remove the mouthpiece and hose from his gas mask easily and inhale through the gas-mask filter. When removed from the gas mask, the open end of the hose can be closed automatically by a check valve or plug.

For both the contaminated- and noncontaminated-atmosphere models, the operator's mouthpiece or mask connection can easily be replaced by bellows. This, however, means more equipment and consequently more weight, a larger package, higher cost, and inflexibility.

SUMMARY

Four resuscitation systems are discussed:

1. *Manual resuscitation.* This method can be used without any equipment and will cause no apprehension. It requires a high degree of training, for which few people can qualify. Lung ventilation is very low, and, as a result, death rate attributable to this system is high.

2. *Automatic resuscitation.* This technic will cause no apprehension. The efficiency rate is highest but the cost factor is comparatively high also and not enough kits are available. A lower death rate would be expected were more equipment available.

3. *Mouth-to-mouth resuscitation.* Like manual resuscitation, this method requires no equipment but arouses a high degree of apprehension on the part of the operator. It requires little training but is highly efficient in lung ventilation. It will fatigue the operator in the shortest time because of hyperventilation. Death rate will be low.

4. *Mouth-to-mask resuscitation.* This method will require little training but some inexpensive equipment will be needed. It will not cause apprehension and will not exhaust the operator. Its efficiency in lung ventilation is high. Death rate will be low and can be improved by equipping all types of vehicles with this small and uncomplicated device.

REFERENCES

1. Cooper, D. Y.: *A Mask-To-Mask Resuscitator Proposed for Chemical Corps Use.* U. S. Army Chemical Corps Medical Laboratory. Special Report ML 10-292-(54).

2. Gordon, A. S.; Frye, C. W.; Gittelson, L.; Sadove, M. S.; and Beattie, E. J., Jr.: Mouth-to-mouth versus manual artificial respiration for children and adults. *J. A. M. A.* 167: 320-328, May 17, 1958.

3. Safar, P.: Ventilatory efficacy of mouth-to-mouth artificial respiration; airway obstruction during manual and mouth-to-mouth artificial respiration. *J. A. M. A.* 167: 335-341, May 17, 1958.

4. Elam, J. O.; Greene, D. G.; Brown, E. S.; and Clements, J. A.: Oxygen and carbon dioxide exchange and energy cost of expired air resuscitation. *J. A. M. A.* 167: 328-334, May 17, 1958.

5. *Holy Bible,* II Kings, chapter 4, verse 34.

6. Seeler, H.: *Design Proposals for Armed Forces Resuscitator Kits.* USAF Aero Medical Laboratory, WADC Technical Report 56-632, AD-110647, Dec. 1956. pp. 11-12.

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The hardest conviction to get into the mind of a beginner is that the education upon which he is engaged is not a college course, not a medical course, but a life course, for which the work of a few years under teachers is but a preparation.—*Sir William Osler*

# ENURESIS IN RECRUITS

## Double Blind Study with Equanil and Review of the Literature

HERBERT M. ADLER, *Lieutenant, MC, USNR*

MOST PHYSICIANS define an enuretic as someone who has not attained nocturnal bladder control by three years of age.[1,2] Currently, the incidence of enuresis in military recruits is about one per cent and it accounts for about one quarter of the neuropsychiatric discharges during recruit training. It is a demoralizing problem both to the individual and to the group in which he functions. Treatment in the military forces is discouraging and more often than not ends in failure and discharge of the recruit. If a simple way could be found on initial interview to differentiate those persons with an excellent prognosis from those with a poor prognosis, therapeutic efforts could be made more effectively. Furthermore, if information gained from a brief initial interview could provide a criterion for establishing whether an anxiety-relieving agent would or would not be indicated, treatment of the selected group would be simplified. It was with these aims that this double blind study and statistical analysis were undertaken.

### REVIEW OF LITERATURE

#### Characteristics of Enuretics

An enuretic is generally considered to be someone who has not attained bladder control by the age of three. It is not known what the incidence of enuresis in the general adult population is, but Levine[3] working with Navy recruits found it to be 12 per 1,000 and noted that enuretics comprise 24 per cent of the neuropsychiatric discharges.

Enuretics generally are not average people who happen to wet the bed as an isolated symptom. Berdie and Wallen[4] found enuretic recruits to have an average general classification test score of 80.10, 20 points below the score of the controls which was 100.55. They differed from the controls also in increased nervousness, lack of confidence, nail biting, somnambulism, talking

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From Marine Corps Recruit Depot, San Diego, Calif. Dr. Adler is now at Pennsylvania Hospital, Philadelphia, Pa.

in their sleep, backaches, and dizzy spells. Studies by Gerard[5] covering 72 cases found that the largest single group consisted of psychoneurotics. The boys were characteristically passive, retiring, self-depreciatory, insecure, slow, and dawdling in activity. No less than 42 per cent of enuretics were found to be nail biters.[3]

Benowitz[6] working with enuretic Air Force recruits found that 50 per cent of them came from homes broken by the separation or divorce of parents. Approximately 60 per cent were rejected by their fathers, felt hostility toward their fathers, or the father was absent from the family picture. Over 50 per cent showed a marked dependence on a mother figure, while 10 per cent were actively homosexual or had strong latent homosexual drives. As a group, they related well to siblings with no excessive rivalry and had little or no conflict with civilian authorities. Only 1 per cent conflicted with Army authorities. Chronic complainers numbered 16 per cent. Unfortunately this study included no controls.

The physical complaints in a group of 100 enuretics were broken down by Shlionsky and associates[7] into the following categories: backache, 59; musculoskeletal, 35; gastrointestinal 13; and cardiovascular, 6.

Pierce and Lipcon[8] found a relationship between enuresis, somnambulism, and epilepsy. They found that 61.8 per cent of sleepwalkers are enuretics and that 26.6 per cent of enuretics are sleepwalkers. The enuretics were four times as likely as the controls to have a family history of somnambulism; they were three times as likely as the controls to have a past personal history of somnambulism; and they were one-and-one-half times as likely as the controls to require dental care. The authors point out that both epilepsy and enuresis have heredofamilial and nocturnal relations, and that some cases of somnambulism are indistinguishable from psychomotor epilepsy. Frary[9] hypothesized that enuresis and dental caries may be related to a disorder of calcium metabolism that influences both.

Backus and Mansell[10] working with 277 enuretics in the British Army were able to classify them into the following personality types: 48 per cent, timid, immature, and dependent (nearly all were persistent bedwetters since infancy without remission); 27 per cent, average; 10 per cent, reaction type, compensatory aggression; 6 per cent, pure aggressives; 6 per cent, sociopaths; and 3 per cent, obsessionals.

Michaels[11] made an interesting classification of enuretics on the basis of their past personal history. He divided enuretics into two groups, (1) transient group, *i. e.*, bedwetting occurred

after the establishment of nocturnal bladder control. These he found to be chiefly neurotic. (2) Persistent group, *i. e.*, persons who had never established nocturnal bladder control. These he characterized as "constitutional." They were lowest in obsessive-compulsive and manic-depressive traits and highest in sociopathy. He observed that character disorders and enuretics had the following traits in common: heightened neuromuscular irritability, impulsiveness, lack of control, and low anxiety tolerance.

In a later publication Michaels[12] hypothesizes that failure of vesicular control is but a focal, localized example of the sociopath's general failure to control his impulses, and states that enuresis is more prevalent in all behavior disorders. Silverman[13] found prolonged enuresis in 33 per cent of criminal psychopaths. This contradicts the study by Benowitz,[6] but is supported by Hirsch[14] who observed that 32 per cent of 367 delinquents were enuretics.

In summary, it appears that enuretics have traumatic childhoods with maternal overdependence and hostility toward their fathers. They tend to be immature and of lower than average intelligence; they have more physical complaints, and are more prone to epilepsy and somnambulism. Most are characterized as passive, dependent, insecure, and timid while many exhibit a generalized sociopathic weakness of impulse control.

### Causative Factors

Enuresis is influenced by almost as many factors as there are investigating specialists in the field. This is quite natural in a symptom complex that involves physiologically several different body systems and is doubtless determined by multiple factors.

The schools of thought may be broken down into four categories: (1) psychologic, as an expression of internal conflict; (2) psychologic, as a failure of training; (3) organic, the genito-urinary system; and (4) organic, the nervous system.

### Psychologic-Internal Conflict

Phyllis Greenacre[15] contends that urination and weeping alike are mechanisms for discharging tensions and that frequently there is a reciprocal relation between the two. Boys are more commonly enuretic than girls because acculturation bars them from tearful discharges. The first tears occur at one month of age and the infant frequently cries in his sleep when he urinates. Weeping is derived from a conflict over childhood urination and penis envy.

This is in essential agreement with Fenichel[16] who notes a passive "letting flow" characteristic of both urination and weep-

ing or, alternatively, fantasies of penetration and destruction. In addition, the urethral discharge and retention pleasure are the unconscious equivalents of and substitutes for masturbation. Further, the fantasies surrounding enuresis are proper to the opposite sex. In girls it is penis envy; in boys, passive urination. This may explain the so frequently found predominance of timid, passive male enuretics.

That enuretics have a past history of unsatisfactory relationships with significant adults, few doubt. The nature of that relationship is considered by Kriegman and Wright[17] to be a too intense emotional attachment to and dependence upon maternal figures. Odlum[18] believes that this factor more than any other accounts for the higher incidence of enuresis in males since males are more indulged and kept more dependent on their mothers than females. Benowitz[6] adds the observation that coupled with this identification with a passive, warm, overprotective mother is an underlying hostility toward the father who is frequently aggressive, abusive, and domineering.

The question arises whether enuresis is the same thing in children and adults. According to the electroencephalogram it is not. Ditman and Blinn[19] found that the childhood enuretic characteristically urinates in deep sleep, the adult enuretic does so in a light sleep. This latter finding seems reasonable when we consider that micturition involves not only the bladder but tension on the abdominal and pelvic muscles, both voluntary muscle groups, to increase intra-abdominal pressure. This brings enuresis within the realm of a dissociative state similar to somnambulism, an aspect which has been elaborated by others.[8]

**Psychologic Factors—Training Failure**

The distinction between training and psychodynamic causes is a vague and perhaps artificial one, especially when we consider the inextricable interpersonal factors involved in bladder training. Huschka[20] speculates that the frequent employment of coercive methods in bladder training may account for the observation that the enuretic child unconsciously uses urine as a destructive agent directed against those whom he wishes to punish. As a further interpretation of the Benowitz case histories[6] the child may introject the abusive father as well as the passive mother. Huschka[20] also points up the sadistic, destructive, and incendiary aspects of enuresis.

The justification for distinguishing training as a significant cause is the fact that, after all, bladder control in our culture is a learned procedure which is imposed on us some time before we are quite ready to accept it. Berdie and Wallen[4] working with enuretic naval recruits found that enuresis frequently results from early environmental conditions that do not favor learning

in general. The recruits' generally lowered academic achievement as expressed in the general classification test score attests to this. The etiology of sociopathic character disorders is not understood but certainly their generalized poor impulse control, that includes poor bladder control, involves the failure to incorporate social pressures.

### Organic—Genitourinary Causes

Forsythe and Karlan[21] working with 25 young male enuretics found urogenital factors to be etiologic in 13 cases and were able to illustrate pathology in 22 out of the 25. They classified the causes of enuresis into two broad categories: (1) urogenital, dysfunction of the detrusor urinae or internal sphincter, verumontanitis, urethrotrigonitis, obstructive or inflammatory lesions; and (2) neurological, lack of cerebral inhibition of the external sphincter.

Some cures were obtained following the urologic procedures. The authors conclude that the good results following urethral dilatation, silver installation, and vesical lavage may have been due in many instances to the inadvertent treatment of local pathology. In evaluating improvement the authors take no account of the inadvertent administration of supportive, suggestive, and coercive psychotherapy associated with their procedures.

Other studies by urologists reveal similarly high incidences of urogenital pathology. Cohen[22] demonstrated a shortened trigone and verumontanum in 24 of 25 random enuretics. Unfortunately, there were no controls.

### Organic-Cerebral Causes

Since enuresis occurs during sleep it is natural to search for its cause in the sleep mechanism. Ström-Olsen[23] implicated the lateral and possibly posterior hypothalamus which are associated with both the sleep-walking mechanism and the mechanism of micturition. Of 28 adult enuretics studied, 25 showed a hypersomnia. They presented a picture of levelheaded, stolid, imperturbable individuals with a characteristic lack of anxiety and a lowered emotional tone. They were incontinent during heavy sleep and he labeled them "saturated sleepers." He found them to have a typically high tolerance for d-amphetamine which had to be pushed to as high as 10 to 30 mg to lighten sleep sufficiently to prevent incontinence. The drug worked, he contended, by increasing corticohypothalamic impulses and the cortical inhibitory impulses to spinal reflexes.

This explanation on the basis of "hypersomnia" is in disagreement with the electroencephalographic studies by Teicher[24] and Ditman and Blinn.[19]

Pierce and Lipcon[8] found statistically significant relationships between enuresis, somnambulism, and dental caries. Frary[9] believed a recessive gene substitute to be active in the etiology of enuresis and that calcium metabolism, through its effects on neuromuscular irritability, may be the responsible factor.

Bisher[25] attributes enuresis to the failure of maturation of subcortical centers which control micturition in the absence of waking cortical control. While reasonable, this explanation is unsatisfactory because it is not susceptible of further study and leaves unanswered, even unguessed at, the reason for the failure of maturation.

In summary, what may well occur is that the presence of increased genitourinary tract irritability from inflammation or low blood calcium, in an individual psychologically prone to a urethral channeling of conflicts, could lower the threshold sufficiently to precipitate enuresis. Similar conditions probably prevail in asthma and other multiple determined dysfunctions of the vegetative nervous system.

**Treatment**

If therapy is to be rational it must be based on an understanding of the etiology. Because this is understood differently by different people, we can expect treatment to follow the general courses delineated by the presumed pathology. Accordingly, treatment generally falls into the following categories:

1. *Psychotherapy* involving an attempt to eliminate psychodynamic causes
2. *Training procedures* which employ learning technics on a symptomatic level
3. *Genitourinary manipulations*
4. *Drug therapy* which attempts to influence cortical, hypothalamic, and autonomic functions

*Psychotherapy.* All who write extensively on this subject are agreed that punitive and coercive methods have no place in the treatment of enuresis. Huschka[20] studying 126 punitively bladder-trained children found that almost half of them, 59, became bedwetters. Doubtless, this method also has its successes but its proponents, such as forceful drill instructors and irate parents, do not publish articles. Success notwithstanding, however, it is presumed to lead to more problems than it eliminates. Also, since enuresis may in part be an expressed aggression following frustrating life circumstances, punishment might easily aggravate and fix the symptom.

On the more positive side, Kriegman and Wright[17] achieved notable success using supportive and minimally exploratory psychotherapy on 25 Army enuretics. They saw the enuretics in

individual sessions in brief psychotherapy averaging 5.4 hours per patient. The general approach was initial acceptance of the patient as he was. After the establishment of a positive rapport, the therapist's firm expectation is that the patient will grow up and discard immature behavior patterns including enuresis.

Enuresis was regarded as stemming psychologically from a lack of satisfactory and appropriate relationships to significant adults. The therapeutic relationship presumably met this need. Kriegman and Wright believed that the military setting of the treatment magnified the therapist as a powerful parental figure, an advantage not enjoyed by the civilian physician. Of 25 patients in treatment, they reported 16 successes, 4 improved, and 5 failures. The failures they found to have an intense emotional attachment to and dependence upon maternal figures.

Three years earlier Backus and Mansell[10] had employed a different psychotherapeutic technic on a larger group of British soldiers with less noteworthy success. Instead of individual therapy they used a group approach with sessions held on the ward. The patients were given breathing exercises in raising the diaphragm to reduce intra-abdominal pressure and thus relax the bladder. They were instructed to exhale and hold the sphincter tight. The suggestion was given repeatedly to "sleep tight," that is, they would sleep with a tight sphincter but the bladder would be asleep and relaxed like the rest of the body. The explanation was given that they would awaken at night from the struggle between a full bladder and a tightened sphincter. Failures were explained away by pointing out that it takes babies three to four years to gain bladder continence and they should not be discouraged, therefore, if success were not immediate.

Backus and Mansell found that difficulties in treatment were associated with age (over 30), chronicity, psychoneurosis, and an anatomically or physiologically small bladder. Of 277 persons treated, 113 were discharged to full duty and 40 were returned to limited duty.

*Training procedures.* Symptomatic treatment of a condition believed to be largely psychogenic in origin frequently stirs up fears as to what will now become of the blocked conflicts hitherto expressed through the symptom in question. What disruptive effects will they have on the psychic homeostasis? Davidson and Douglass[26] challenge this approach as sterile and harmful. These authors treated 20 cases with an electrified mattress that rang an alarm at the first few drops of urine. There were 3 females and 17 males ranging in age from 5 to 30 years. Fourteen were cured and six improved.

They contend that while enuresis may once have played an important role in maintaining intrapsychic homeostasis, it may

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persist long after the original causes are no longer operative. Then, it becomes no longer a response to anxiety and frustration but a stimulus itself calling forth these inimical feelings and impeding emotional growth and social adjustment. In their group, they found that once enuresis was relieved the personality frequently changed from a shy to an assertive one.

Just as Huschka[20] discredited the age-old punitive method, so Odlum[16] decried the other popular technic, namely water restriction. He contended that excessive water restriction frequently aggravates enuresis by increasing the concentration of the urine and causing bladder-neck irritation. This may account for the occasional success reported with diuretics.[27] Going to the other extreme, Nichols[28] encouraged his patients to drink fluids in excess and to achieve bladder mastery through voluntary daytime inhibition of the external sphincter reflex, waiting increasing periods of time after the urge to urinate became felt.

Berdie and Wallen[4] used similar daytime bladder control but added to it environmental manipulation in order to alleviate external sources of anxiety.

*Drug therapy.* Because micturition involves several physiologic systems and because there are many drugs with known effects on these systems, it is not surprising that a great variety of drugs should have their advocates and their rationales. Only one typical drug from each class will be discussed.

1. *Parasympathetic inhibitors.* Because of its effects in blocking reflex bladder emptying, Banthine (brand of methantheline bromide) in doses of 50 mg at bedtime has long been the mainstay of practitioners. One study[29] reports 8 successes out of 11 patients treated. No controls were included and personal experience does not confirm this.

2. *Subcortical inhibitors.* Reserpine was used by Lambros[30] in 1.5 mg daily doses because of its inhibiting effect on efferent stimuli to the hypothalamus, the highest center of the autonomic nervous system. He achieved initial success in 16 out of 17 cases treated but could repeat his good results on only 1 patient after a two-week intermission without the drug.

3. *Cortical stimulants.* D-Amphetamine in doses from 10 to 30 mg at bedtime was used by Ström-Olsen,[23] both because of its established success in lightening sleep and facilitating cortical control and its presumed effect on the lateral and posterior hypothalamus which are associated with the sleep-waking mechanism and the mechanism of micturition. Daytime bladder control is maintained by cortical inhibitory impulses to spinal reflexes and corticohypothalamic impulses. The author contends that d-amphetamine in large doses re-establishes cortical primacy.

*Hormones.* Methyltestosterone was used on 50 children aged 3.5 to 14 years via injection, orally, or by topical application to the lower abdomen once or twice daily. It was hypothesized by Schlutz and Anderson[31] that this stimulated the maturation of a basically immature urogenital system. They found that 54 per cent were completely cured, 34 per cent were much improved, and 16 per cent showed no improvement.

None of the above studies had any controls. One very well conceived experiment by Browne and Smith[27] in an orphanage tested a variety of drugs including ephedrine, extract of belladonna, Trasentine (brand of adiphenine hydrochloric acid), physostigmine, and theophylline, using controls, and found no significant results from any of them. A diuretic, mersalyl, had a good effect for three weeks, but in the fourth week results were poor.

*Genitourinary manipulations.* Those who believe organic pathology to be etiologic in enuresis also pursue therapeutic technics aimed at eliminating this pathology. Forsythe and Karlan[21] employed urethral dilatation, silver installation, and vesical lavage. No figures are given for the results of this treatment but some successes are implied.

**Comments**

The treatments for enuresis range as far afield as the theories of its causes. That there are many therapeutic triumphs is everywhere in evidence. There is rarely, however, any control and even more rarely any attempt to characterize the psychologic and physiologic differences between the successes and the failures.

Psychotherapeutic cures range from 64 per cent[17] with individual therapy to 41 per cent[10] with group therapy. Training procedures with an electrified mattress yield as high as 70 per cent cures, while some[29] report as high as 73 per cent with drugs. Few people publicize their failures but it seems likely, from the foregoing, that any therapeutic attempts on a nonselected population should be crowned with successes in at least 40 per cent of cases treated. The lower age groups with higher spontaneous remission rates yield correspondingly higher percentages of cures.[32]

## METHODS OF STUDY

The subjects for this experiment were 102 male recruits between 17 and 20 years of age who were undergoing boot training. These men were sent to the neuropsychiatric unit by their drill instructors or the sick-call physicians because of current enuresis. The frequency of enuresis ranged from once a week to seven times a week. A urinalysis was done on each man and he

was closely questioned for symptoms of genitourinary pathologic abnormalities. No one with any evidence of organic defect was included in the experimental group. Urinary frequency was a common symptom but in the presence of a negative urinalysis and in the absence of related symptoms it was considered functional. Except for the above restrictions, no enuretic was excluded from the experiment. The data was collected during the period from July 1957 to April 1958.

**Factors Studied**

The following factors were evaluated:

1. *Motivation.* Positive or negative motivation for duty in the Marine Corps was judged according to the recruit's own statement and his drill instructor's opinion.
2. *Personality.* A passive or aggressive personality type was determined in the initial interview and from the drill instructor's description of his performance at duty. The "aggressives" were the hard-driving persons who functioned at a high-energy level and often exhibited leadership qualities. The "passives" were typically timid, accepting their symptom, and unlike the aggressives, gave no history of active personal attempts to overcome their enuresis.
3. *Unclassified.* Only the extremes at either end of the continuum of "motivation" and "personality" were so designated. Where there was any doubt about either, the recruit was considered "unclassified" with regard to both these factors.
4. *Treatment.* Either Equanil (brand of meprobamate) or a placebo was dispensed according to a double blind technic.

The management of the enuretics consisted of supportive and suggestive psychotherapy which was the same for everyone, plus the distribution of medication which was divided equally between a placebo and Equanil.

Psychotherapy centered around a brief explanation of micturition together with bladder exercises and a self-regulated stepwise increase in dosage. The exercises required no fluid restrictions but involved a positive attempt by the recruit to delay urination for varying periods of time beyond his initial urge to void. A feeling of acceptance and optimism were communicated to the recruit.

Medication consisted of bottles of 50 tablets and all tablets were stamped in the same mold. The bottles were marked either "1" or "2" and it was not known to the experimenter until the conclusion of the experiment which contained Equanil and which a placebo. The recruits received either one or the other medication but never both.

The recruits were instructed to take one tablet four times daily until they wet the bed. At that time they were to increase the dosage to two tablets three times daily. If enuresis continued, they were then instructed to increase the dosage to two tablets four times daily and to continue at this dosage level until their reappointment date.

5. *Continuity.* Enuresis was classified as either transient or persistent, as determined from the initial interview. The transient enuretics were those who gave a history of a remission in their symptom of at least one year's duration at any time in their life. The persistent enuretics were those who gave no such history of a significant remission.

6. *Disposition.* Either cured or uncured enuresis was determined by the recruit's response to his treatment. Those who had overcome their enuresis completely or did not wet the bed more than once in a three-week period were considered "cured" and kept at full duty. Those who continued to wet the bed more than once in a three-week period were considered uncured and discharged from the service. This was determined by written records kept both by the recruit himself and independently by the drill instructor.

## EXPERIMENTAL GROUPS

On the basis of a combination of two or more factors the following groups were identified and studied.

*Group I* consisted of 50 recruits. This group was designed to test the effectiveness of the factors of motivation, personality, and treatment on disposition.

*Group II* consisted of 52 recruits. It was designed to test the effectiveness of treatment alone on disposition.

*Group III* consisted of the last 36 recruits collected in the experimental sample of the 102 studied (Groups I and II). This group was designed to test the effectiveness of continuity on disposition.

### Schedule of Evaluations

The initial interview lasted about 25 minutes and consisted of history taking, evaluation with regard to pertinent factors, distribution of medication, and brief psychotherapy.

The second interview came three weeks later. All unused medication was returned. Those classified as uncured were admitted to the psychiatric observation ward for at least one week before discharge, while those classified as cured were returned to duty with a reappointment in three weeks.

The third interview came three weeks after the second one and a similar procedure was followed for the cured and uncured groups.

The group considered cured at the third interview was followed to graduation from boot camp and again to the successful completion of advanced infantry training at Camp Pendleton.

### Recording of Data

The data were recorded in two ways: (1) As the sum of frequencies of enuresis before, during, and after treatment; (2) According to the final disposition of the recruits as cured or uncured.

### Analysis and Results

*Group I.* Originally, it had been planned that the data were to be statistically analyzed as a three-way unequal subclass frequency analysis of covariance design. Preliminary analysis and tests indicated, however, that the motivation factor did not have a significant effect nor did it interact to any great degree with the personality and treatment factors. Therefore, the motivation factor was abandoned to simplify the statistical analysis.

The independent variable was the frequency of enuresis during a three-week period prior to treatment and the dependent variable was the frequency of enuresis during a three-week period after treatment (table 1). No use was made of the frequency figure

TABLE 1. *Effect of treatment and personality on frequency of enuresis*

| Personality | Treatment | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equanil | | | Placebo | | | Average | | | |
| | N | Pre-Rx | Post-Rx | N | Pre-Rx | Post-Rx | N | Pre-Rx | Post-Rx | P |
| Passive | 16 | 10.88 | 11.38 | 16 | 11.12 | 10.25 | 32 | 11.00 | 10.81 | >.30 |
| Aggressive | 11 | 8.64 | 3.82 | 7 | 5.57 | 6.71 | 18 | 7.44 | 4.94 | .15 |
| Average | 27 | 9.96 | 8.30 | 23 | 9.43 | 9.17 | 50 | 9.72 | 8.70 | >.40 |

Pre-Rx = frequency of enuresis during a three-week period prior to treatment.
Post-Rx = frequency of enuresis during a three-week period after treatment.
N = the number of recruits.
P = probability expressed as a level of confidence.

for the three-week period during treatment. For those uncured recruits who were admitted to the psychiatric observation ward after the second interview, the sum of the one-week frequency of observed enuresis was multiplied by three to make it comparable to the cured recruits who stayed on duty.

The statistical analysis showed that the treatment means were not suggestive of a significant difference ($F < 1.00$) either when analyzed independently of the pretreatment effect or adjusted for them through an analysis of covariance.

The analysis of covariance of the aggressive personality was suggestive of interaction with Equanil.

Obviously the observed proportion of cured patients using Equanil equaled the observed proportion of cured patients using

the placebo and no statistical procedure was necessary to test the effectiveness of the treatments on the basis of disposition. There was no difference between the group tested with Equanil and the group tested with the placebo.

*Group II.* Table 2 shows the effect of treatment on disposition of the entire sample (102 recruits). Data on effect of treatment in an unclassified group is shown in table 3.

TABLE 2. *Effect of treatment in 102 recruits*

| Disposition | Treatment | |
|---|---|---|
| | Equanil | Placebo |
| Cured | 22 | 22 |
| Uncured | 29 | 29 |
| Total | 51 | 51 |
| Proportion cured | .43 | .43 |

TABLE 3. *Effect of treatment on the frequency of enuresis in an unclassified group*

| Equanil | | | Placebo | | | Average | | | |
|---|---|---|---|---|---|---|---|---|---|
| N | Pre-Rx | Post-Rx | N | Pre-Rx | Post-Rx | N | Pre-Rx | Post-Rx | P |
| 24 | 7.71 | 7.76 | 28 | 8.64 | 7.29 | 26 | 8.21 | 7.53 | >.40 |

Pre-Rx = frequency of enuresis during a three-week period prior to treatment.
Post-Rx = frequency of enuresis during a three-week period after treatment.
N = the number of recruits.
P = probability expressed as a level of confidence.

An analysis of variance showed the posttreatment means to be not significantly different ($F<1.00$) from the pretreatment means. This was also true when the posttreatment means were adjusted for the pretreatment means by an analysis of covariance procedure.

*Group III.* Data concerning recruits in group are given in table 4.

Preliminary analysis indicated that the factors of motivation, personality, treatment, and disposition did not have a significant effect or interact to any great degree with each other. Therefore, continuity and disposition were treated as a two-factor contingency table.

## DISCUSSION

The classification of initial motivation for duty was chosen because it was believed that if a recruit saw some secondary gain in his symptom, such as a hoped for discharge, he might not try too hard to overcome it or he might be an outright ma-

lingerer. The results did not bear out this point. Initial motivation did not affect either the frequency of enuresis or the final disposition of the enuretic. The explanation for this may lie in the fact that the experimental procedure required that all enuretics remain at duty for three weeks before being seen again at the neuropsychiatric unit. The line officers co-operated effectively with this procedure. It may be that there was so much social pressure in the platoon setting that, even if a recruit were initially content to wet the bed and be discharged, these pressures stimulated him to overcome his enuresis if he could. In other words, further trial at duty neutralized or nullified some of the secondary gain involved in enuresis.

The personality classification of "passive" or "aggressive" was chosen because the psychoanalytic literature[16] distinguishes between the passive, feminine, "letting flow" fantasies and the active, masculine, sadistic fantasies of penetration. Because

TABLE 4. *Relation of continuity of enuresis to disposition*

| Disposition | Persistent | Transient | Total number | Per cent transient |
|---|---|---|---|---|
| Cured | 5 | 11 | 16 | .68 |
| Uncured | 18 | 2 | 20 | |
| Total | 23 | 13 | 36 | .36 |
| Proportion cured | .22 | .85 | .44 | P = <.001 |

$X^2 = 13.3$ degrees of freedom = 1

the relatively superficial nature of the contact with the recruits did not allow an honest determination of sadism in the individual, the more easily arrived at label of "aggressive" was used instead.

It was believed at the outset that Equanil, a muscle-relaxant and anxiety-relieving agent, might benefit the aggressive individual but work to the detriment of the passive individual. This was only partially borne out (table 1). There was no difference in the response of the passive enuretic to Equanil, as compared with a placebo. The aggressive enuretic, however, benefited more from Equanil than he did from a placebo and this difference reached a level of confidence of .15.

The passive enuretic in this sample is probably the same stolid, imperturbable, "saturated sleeper" that Ström-Olsen[23] described and the timid, immature, dependent, persistent enuretic that Backus and Mansell[10] had difficulty treating. Ström-Olsen reported good results with large doses of d-amphetamine, a cortical stimulant, but Backus and Mansell encountered difficulty in group therapy with this type. The relatively poorer results of

Equanil with the passive enuretic in this experiment are therefore not surprising. It would seem that in this type of individual a little constructive anxiety would be a good thing.

For the aggressive enuretic, Equanil probably brought about an appropriate alleviation of emotional tension (perhaps abdominal and pelvic muscular tension) that may have made a urethral discharge of conflicts less necessary or less possible. So, while the over-all effect of Equanil and a placebo were the same (tables 2 and 3) this personality-treatment trend stands out and is entitled to consideration in differential treatment of clearly identified aggressive enuretics.

It was observed (tables 1 and 3) that passive enuretics characteristically had a higher pre-treatment frequency of enuresis than either the aggressive or unclassified enuretics. This distinction attained a level of confidence of *less than* .05.

The supportive and suggestive psychotherapeutic approach used for the entire sample was essentially a combination of the the technics described by Backus and Mansell[10] and Berdie and Wallen.[4] The "physiologic" explanation, the "bladder exercises," and the self-regulating dosage schedule were designed to give the enuretic a sense of mastery and control over a symptom in whose grip he found himself helplessly entangled. It was hoped that in an understanding but demanding atmosphere his role would be transformed from a passive to an active participant in the management of his problem. Nothing beyond this is claimed for these technics and other approaches could accomplish the same effect.

On purely experimental grounds, it was unfortunate that there were no controls for the psychotherapy. This opportunity was foregone because it was considered that the primary purpose of the neuropsychiatric unit was to do everything possible to help these recruits to complete their training successfully.

Berdie and Wallen[4] published no figures but Backus and Mansell[10] did and they were able to return 41 per cent of the 277 cases treated to full duty. The constitution of their sample, psychotherapeutic technic, criteria for cure, and results are almost identical with those employed in our experiment. The one exception is the adjunct of Equanil and a placebo for which no significant over-all difference was found (tables 2 and 3). Since the psychotherapeutic approaches and the rates of cure for these two studies were essentially the same, it seems reasonable to conclude that the effective factor in this experiment, similar to the Backus and Mansell experiment, was psychotherapy. One might add also that any intensive treatment program for a similar population of enuretics should achieve at

least a 40 per cent rate of cure. Indeed, few investigators report a lower rate. It would be interesting and perhaps fruitful to combine established psychotherapeutic technics of self-mastery, suggestion, and support with some of the high-yield drugs reported in the current literature.

Unfortunately, it was not until two-thirds of the experimental sample had been collected that the significance of a history of continuity or lack of continuity of the enuretic symptom became evident. Consequently, only the last 36 cases collected were classified with regard to continuity, either persistent or transient. This distinction had been described first by Michaels[11] in 1941 but no special use had been made of it as a prognostic indicator. About one third of the 36 recruits in group III (table 4) could be classified as transient enuretics and they had a rate of cure of 85 per cent. The rate of cure for the two-thirds who were persistent enuretics was only 22 per cent. The difference in disposition between these two groups is significant at a level of confidence of less than .001. The disposition for group III was not significantly affected by motivation, treatment, or personality factors. The number of cases was too small to justify a statement of personality differences between the transient and persistent enuretics. However, the impression gained was that the persistent enuretics tended to fall into the passive classification.

It may be that this symptom in the transient enuretic represents a reactive, situational regression of more or less fleeting significance in the personality structure. On the other hand, persistent enuresis probably represents something insidious and pervasive about the personality structure that justifies its consideration as a separate syndrome. The significantly different response to therapy supports this distinction. The difference in prognosis between these two groups may also serve as an indication or contraindication for treatment in the military.

The proportion of "cured" for group III is .44. This is essentially the same as the .43 proportion for the entire sample of 102 recruits, indicating that group III constituted a representative sample of the whole. The transient enuretics made up .36 of group III but accounted for .68 of the cures. It is likely, therefore, that had the classification of continuity been applied to the entire sample of 102, it would have been found that two-thirds of the number cured was composed of transient enuretics although they constituted only one-third of the sample.

Support is gained for the symptomatic treatment of enuresis by the fact that of the 44 cured enuretics all but 3, who received medical surveys for unrelated causes, graduated from boot camp

and successfully completed one month of advanced infantry training at another base.

## GENERAL OBSERVATIONS

Reference to current psychiatric and urologic literature and the results of this experiment justify certain general observations.

In about one-third of young adult enuretics the symptom represents little more than a regression under stress and is best handled by supportive and suggestive psychotherapy (including a placebo) while the individual remains undisturbed in his occupation. The prognosis with treatment is excellent and the spontaneous remission rate is probably high.

In about two-thirds of this same group enuresis may be intimately associated with one or more characteristics such as physical immaturity, below average intelligence, passivity, poor impulse control, latent homosexuality, epilepsy and dissociative reactions. In these individuals who have never established nocturnal bladder control, enuresis almost universally may be considered an indication of a deep personality disorder.

A wide variety of treatments have met with success and the approximately 40 per cent cure rate from psychotherapy alone is the least one can expect from a therapeutic program. In the military, where treatment is limited, it can be applied most profitably to the group of transient enuretics because they have the best prognosis and are least likely to represent deeper personality disorders.

## TOWARD A GENERAL THEORY OF ENURESIS

Enuresis as a symptom represents different things in different age groups and personality structures. Enuresis during light sleep in the adult is distinguished from enuresis during deep sleep in childhood and may be in the nature of a dissociative reaction in the former. Further, in some adults with a history of well-established bladder control it may represent a transient, generalized regression in the face of stress. For others with no history of bladder control it may be the final common pathway of inimical psychogenetic and constitutional forces.

Micturition is a complex function. When the intravesical tension rises above a certain level, rhythmical contractions of the detrusor urinae muscle are set up. This is accompanied by relaxation of the internal sphincter and followed by opening of the external sphincter. Increasing intra-abnominal pressure by contraction of the rectus abdominis and perineal muscles can accelerate this. The micturition reflex is mediated by the autonomic nervous system, the sympathetic and parasympathetic

nerves being reciprocal in their actions. This function, however, is unusual in that centers for micturition are situated in the midbrain, hindbrain, hypothalamus, spinal cord, and premotor cortex so that voluntary inhibition or facilitation of the reflex is frequent. As there are so many physiologic pathways leading to micturition and involving conscious and unconscious components and as a major dysfunction of any one of these alone or minor dysfunctions of any several of these can culminate in enuresis, it is not surprising that a specific cause has eluded us. Rather, it might be more accurate to think of functional and constitutional factors acting in concert. It has long been accepted that not everyone is susceptible to ulcers, cancer, hypertension, asthma, or schizophrenia: Life situations may evoke these but a stimulus must act on a responsive matrix. Such might be the nature of enuresis. Certain inimical early life conditions prevail. Recurrent among these are passive identification with mother, sadistic identification with father, impaired ability to incorporate social demands. Somehow, perhaps because these malevolent factors coincide chronologically with the serial maturation of bladder control centers, and because bladder control may become involved in the symbolic expression of passive and sadistic drives and fantasies (analagous to bowel control), conflicts become prone to a urethral pathway of discharge.

Facilitating or inhibiting this mode of discharge are such organic factors as the neural maturation of spinal and subcortical centers, cerebral cortical dysrhythmias, and the threshold of irritability (in health and disease) of the entire genitourinary tract. Many of these vectors vary from day to day and most are amenable to various treatments including psychotherapy, drug therapy and habit training. Many, too, change with growth and development which accounts in part for a certain spontaneous remission rate.

Once firmly established, enuresis, like stuttering, may persist long after the initiating causes have subsided. When this situation prevails a symptom which was once the result of personality difficulties now becomes a self-perpetuating cause of personality difficulties and purely symptomatic management is justified.

## SUMMARY

One hundred and two enuretic recruits were subjected to a double blind study involving Equanil and a placebo in conjunction with supportive and suggestive psychotherapy. No over-all difference was established between the two drugs, the remission rate for each being 43 per cent. Analysis of personality features, however, indicated that Equanil selectively benefited the aggressive enuretics. A significant difference in the prognosis for transient and persistent enuretics was found

and could serve as an indication for retention or separation from the service.

## CONCLUSIONS

Initial motivation for service does not significantly affect the results of the treatment of enuretics who are maintained at duty for at least three weeks beyond the initiation of therapy. Passive enuretics show no difference in response between Equanil and a placebo. Aggressive enuretics benefit more from Equanil than from a placebo.

In an unselected group of young adult enuretics there is no significant difference between treatment with Equanil and treatment with a placebo. Supportive and suggestive psychotherapy can effect a cure rate of 43 per cent in enuretic recruits. These cures are maintained for at least two months after the cessation of therapy. Passive enuretics have a higher frequency of enuresis than either aggressive enuretics or the average unclassified enuretic.

The alleviation of the symptom of enuresis in a recruit appears to help his total adjustment in training and seems to have no deleterious effect on his personality. Approximately one third of enuretic recruits can be classified as transient enuretics. Their rate of cure with psychotherapy is 85 per cent. Retention at duty and intensive therapy is justified in a recruit who meets the criteria of a transient enuretic. Approximately two thirds of enuretic recruits can be classified as persistent enuretics. Their rate of cure with psychotherapy is 22 per cent.

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## REFERENCES

1. Michaels, J. J.: *Disorders of Character.* Charles C Thomas, Springfield, Ill., 1955. p. 7.

2. Kanner, L.: *Child Psychiatry.* 2d edition. Charles C Thomas, Springfield, Ill., 1948. p. 428.

3. Levine, A.: Enuresis in the Navy. *Am. J. Psychiat.* 100: 320-325, Nov. 1943.

4. Berdie, R. F., and Wallen, R.: Some psychological aspects of enuresis in adult males. *Am. J. Orthopsychiat.* 15: 153-159, Jan. 1945.

5. Gerard, M. W.: Enuresis; study in etiology. *Am. J. Orthopsychiat.* 9: 48-58, Jan. 1939.

6. Benowitz, H. H.: Enuretic soldier in AAF basic training center; study of 172 cases. *J. Nerv. & Ment. Dis.* 104: 66-79, July 1946.

7. Shlionsky, H.; Sarracino, L. R.; and Bischof, L. J.: Functional enuresis in Army; report of clinical study of 100 cases. *War Med.* 7: 297-303, May 1945.

8. Pierce, C. M., and Lipcon, H. H.: Clinical relationship of enuresis to sleepwalking and epilepsy. *A. M. A. Arch. Neurol. & Psychiat.* 76: 310-316, Sept. 1956.

9. Frary, R.: Enuresis; genetic study. *Am. J. Dis. Child.* 49: 557-578, Mar. 1935.

10. Backus, P. L., and Mansell, G. S.: Investigation and treatment of enuresis in Army; preliminary report on 277 cases. *Brit. M. J.* 2: 462-465, Oct. 7, 1944.

11. Michaels, J. J.: Parallels between persistent enuresis and delinquency in psychopathic personality. *Am. J. Orthopsychiat.* 11: 260-274, Apr. 1941.

12. Michaels, J. J.: Significance of persistent enuresis in history of psychopathic personality. *Mil. Surgeon* 95: 315-316, Oct. 1944.

13. Silverman, D.: Clinical and electroencephalographic studies on criminal psychopaths. *A. M. A. Arch. Neurol. & Psychiat.* 50: 18-33, July 1943.

14. Hirsch, N. D. M.: *Dynamic causes of juvenile crime.* Sci-Art Publishers, Cambridge, Mass. 1937. 250 pp.

15. Greenacre, P.: Urination and weeping. *Am. J. Orthopsychiat.* 15: 81-88, Jan. 1945.

16. Fenichel, O.: *The Psychoanalytic Theory of Neurosis.* W. W. Norton & Co., Inc., New York, N. Y., 1945. pp. 68-69.

17. Kriegman, G., and Wright, H. B.: Brief psychotherapy with enuretics in Army. *Am. J. Psychiat.* 104: 254-258, Oct. 1947.

18. Odlum, D. M.: Nocturnal enuresis. *Brit. M. J.* 1: 8-10, Jan. 6, 1940.

19. Ditman, K. S. and Blinn, K. A.: Sleep levels in enuresis. *Am. J. Psychiat.* 111: 913-920, June 1955.

20. Huschka, M.: Study of training in voluntary control of urination in group of problem children. *Psychosom. Med.* 5: 254-265, July 1943.

21. Forsythe, W. E., Jr., and Karlan, S. C.: Enuresis in young male adults. *J. Urol.* 54: 22-38, July 1945.

22. Cohen, D. L.: Nocturnal enuresis in adult male; urological study. *J. Urol.* 57: 331-337, Feb. 1947.

23. Ström-Olsen, R.: Enuresis in adults and abnormality of sleep. *Lancet* 2: 133-135, 22 July 1950.

24. Teicher, J. D.: Enuresis; critical review of symptom. *California Med.* 82: 392-395, May 1955.

25. Bisher, W.: Enuresis in adult. *Mil. Surgeon* 96: 244-246, Mar. 1945.

26. Davidson, J. R., and Douglass, E.: Nocturnal enuresis: special approach to treatment. *Brit. M. J.* 1: 1345-47, June 10, 1950.

27. Browne, R. C., and Smith, A. F.: Enuresis in adolescents. *Brit. M. J.* 2: 803-805, Dec. 6, 1941.

28. Nichols, L. A.: Enuresis, its background and cure. *Lancet* 271: 1336-1337, Dec. 29, 1956.

29. O'Malley, J. F., and Owens, R. H.: Banthine therapy for enuresis. *Missouri Med.* 50: 188-189, Mar. 1953.

30. Lambros, V. S.: Use of reserpine in certain neurological disorders: organic convulsive states, enuresis, and head injuries. *Ann. New York Acad. Sci.* 61: 211-214, Apr. 15, 1955.

31. Schlutz, F. W., and Anderson, C. E.: Endocrine treatment of enuresis. *J. Clin. Endocrinol.* 3: 405-407, July 1943.

32. Pierce, C. M.; Lipcon, H. H.; McLary, J. H.; and Noble, F. H.: Enuresis; psychiatric interview studies. *U. S. Armed Forces M. J.* 7: 1265-1280, Sept. 1956.

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## OBSTETRICS IN ORBIT

Rocket ships are coming sooner than you think—and what's more, they'll need OB men aboard. This prediction emerges from a recent meeting of the American Rocket Society. Experts there opined that tomorrow's typical astronauts will be husband-and-wife scientist teams, living for years in space and begetting children en route. One OB man, after reading this news, announced to local colleagues that he was already planning a paper entitled "Breech Delivery Under Null-Gravity Conditions." Outer-Space Obstetrics: *Medical Economics,* September 1, 1958.

# THE CHOICE OF APPENDECTOMY INCISION IN ADULT FEMALE PATIENTS

F. RICHARD WALTON, *Lieutenant, MC, USN*
MARVIN L. GERBER, *Captain, MC, USN*

PRIOR to 1893, operations for appendicitis were carried out through incisions parallel to the lateral edge of the right rectus muscle. McBurney[1] observed that with this incision one consumed time and effort opening the peritoneal cavity, still resulting in the operator working beneath an overhanging shelf formed by the outer part of the abdominal wall, since the appendix usually lies to the right of the incision. He then developed the incision which today bears his name.

Since then, much has been written and much more has been said about the proper incision to be selected in approaching an inflamed appendix. In general, the debate has settled down to the McBurney, or gridiron muscle-splitting incision, versus the vertical procedures for entrance into the abdominal cavity.

At this hospital both types of incisions have been used, especially in female patients. This is a report on the use here of the McBurney incision as compared with the vertical procedures in one specific group of patients, women and girls over the age of 8 years in whom an operation was performed with a preoperative diagnosis of acute appendicitis. This review covers the period from January 1956 to July 1958 and includes 73 female patients. The age range was from 7 to 82 years with an average of 23.6 years. The total number of patients having McBurney incisions was 58 (79.4 per cent); the remaining 15 (20.6 per cent) being vertical. One patient had both a McBurney and a vertical incision.

The average total of hospital days for all 73 patients was 6.85. The average for the patients in whom the McBurney incision was used was 6.5 days, and for those with the vertical 8.5 days. One might question this figure and state that obviously the vertical incisions were indicated by a more extensive pathologic condition; but in practice just the opposite occurred. The more

From the Surgical Service, U. S. Naval Hospital, Oakland, Calif.
Presented by Dr. Walton at a meeting of the San Francisco Surgical Society on 19 November 1958.

serious operative findings with possible serious consequences such as perforation and abscess were found through McBurney-type procedures. Actually, this finding is in keeping with those of many other authors who report a shorter convalescent period with the McBurney technic. Gatch and Durman[2] reported that the McBurney incision was used in 229 of 262 consecutive patients operated on for appendicitis. They had far less difficulty with those in whom the McBurney incision was used and convalescence was shorter as well. Truesdell[3] reported 259 appendectomies, McBurney's incision being used in 238 of them, and reached the same conclusions.

Criticism of the McBurney incision has been that if one finds pelvic abnormalities or other conditions away from the right lower quadrant, the exposure is inadequate. There seems to be general agreement that if a condition other than acute appendicitis is strongly suspected, and particularly if extensive abdominal exploration is indicated, a vertical incision of some sort should be used. However, in those situations where one believes the disease most likely is acute appendicitis and on opening the peritoneum finds a situation demanding more exposure, it is a relatively simple task to extend the incision.[4] This belief and practice has been reported by many authors and investigators but, as stated specifically by Allen,[5] those objecting to the use of the McBurney incision for appendicitis do so on the basis that the exposure is limited in patients where the malady lies elsewhere, particularly in the left tube or ovary. Because the incision can be expanded or extended readily, this criticism, he thought, seems unwarranted. Mason and associates[6] used a McBurney incision routinely and needed to enlarge the original wound only 16 times in 545 operations, an incidence of 2.97 per cent. Our figures show 5 extensions in 58 McBurney incisions, an incidence of 8.6 per cent, and another incision was performed in one case, making a total average of 9.65 per cent incidence where it was necessary either to extend the incision just made or make an additional one. Even in the last-mentioned case where a McBurney incision was closed and a midline one performed for a bleeding cyst of the right ovary, an element of doubt exists concerning the need for the second opening.

Another basis for comparison of the two essential types of incisions for acute appendicitis is the relative frequency of postoperative wound complications. In the 73 cases here, there were no instances of dehiscence or postoperative hernia. The McBurney incisions were infected following operation, especially in perforated cases, in 9 instances, but no hernias occurred. Carlucci[7] had 32 cases of postoperative hernias in 700 appendectomies (4.3 per cent); 386 of the incisions were McBurney's, with 16 herniations (4 per cent). In 250 vertical incisions, 12 hernias (5 per cent) occurred. The closeness of these figures is due to the fact that most of the "McBurney" hernias followed wound infection and drainage, inasmuch as this incision was

preferred for appendicitis with perforation. Certainly no definite statements can be made from our small series regarding wound complications, but it seems reasonable to presume that the gridiron incision leaves a stronger abdominal wall than a vertical one.

Most surgeons seem to agree that in women where the diagnosis is most likely acute appendicitis, the McBurney type of incision is the one of choice, although many insist on the vertical type because of the possibility of encountering other pelvic disease. In our series, 57 of the 58 patients with McBurney incisions had no difficulty and the operations were readily completed, aided by extensions in 5 cases. In one case, the incision was considered inadequate at the time and another was required. In 2 of the 16 patients with vertical incisions, the pathologic condition justified that decision, but in those 2 the preoperative diagnoses were in doubt from the beginning and at operation were found to be acute cholecystitis and a bleeding ovary.

## SUMMARY

In the process of examining the histories of the 73 appendectomies reported here with respect to the choice of incision, the following question was kept in mind: Is it wise to subject all women being operated upon for acute appendicitis to the increased morbidity of a vertical incision, for the sake of the rare occasion when a second incision might be required to supplement that of an inadequate gridiron type? It has not been possible to settle the issue on statistical grounds, but some evidence has been found to support a negative answer to the question. No concrete conclusions can be drawn from our results, but some interesting data have been compiled which support those reported in the literature.

## REFERENCES

1. McBurney, C.: Incision made in abdominal wall in cases of appendicitis, with description of new method of operating. *Ann. Surg.* 20: 38-43, July 1894. Cited in Boyce, F. F.: *Acute Appendicitis and Its Complications.* Oxford University Press, New York, N. Y., 1949. p. 263.

2. Gatch, W. D., and Durman, D. C.: Report on 262 consectutive cases of appendicitis. *Ann. Surg.* 79: 862-870, June 1924.

3. Truesdell, E. D.: Surgical treatment of acute appendicitis. *Ann. Surg.* 84: 104-111, July 1926.

4. Royster, H. A.: *Appendicitis.* Surgical Monographs under the editorial supervision of Dean Lewis, Eugene H. Pool, and Arthur W. Elting. D. Appleton & Company, New York, N. Y 1927.

5. Allen, J. G.: Appendicitis and the acute abdomen. In Allen, J. G.; Harkins, H. N.; Moyer, C. A.; and Rhoads, J. E. (editors): *Surgery, Principles and Practice.* J. B. Lippincott, Philadelphia, Pa., 1957. p. 810.

6. Mason, M. L.; Allen, H. S.; Queen, F. B.; and Gibbs, E. W.: Review of 1,000 consecutive appendectomies. *Quart. Bull. Northwestern University Medical School* 15: 1-20, 1941. Cited in Boyce, F. F.: *Acute Appendicitis and Its Complications.* Oxford University Press, New York, N. Y., 1949. p. 265.

7. Carlucci, G. A.: Cited in Boyce, F. F.: *Acute Appendicitis and Its Complications.* Oxford University Press, New York, N. Y., 1949. p. 256.

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# THE ETIOLOGY OF POSTDECOMPRESSION SHOCK IN AIRCREWMEN

W. LOCKHART RAIT, *Wing Commander, RAAF*

THE hypothesis proposed in this report was suggested early in 1952 during a visit to the Royal Air Force Institute of Aviation Medicine, at Farnborough, England. Before this, I had been interested in the subject of decompression sickness but previously had not heard postdecompression shock discussed in relation to fatal cases, as such occurrences had been unknown in the Royal Australian Air Force. On returning to Australia in August 1952, I submitted a hypothesis to the Director General of Medical Services, Royal Australian Air Force, requesting approval to begin an official investigation in collaboration with the University of Melbourne. This was granted, a project was initiated and a grant of money was allocated to the University of Melbourne for the purchase of apparatus and for the procurement and maintenance of laboratory animals.

From the outset, I recommended that, whether or not the hypothesis was true, the postulated predisposing cause of postdecompression shock, a fatty liver, should be eliminated as far as possible in aircrews by dietetic instruction and, where necessary, by specially approved diets. This has been the policy in the Royal Australian Air Force, since 1952, at all stations where aircrews have been engaged in high-altitude flying. Apart from the single case discussed later, there have been no postdecompression collapses recorded in Australia.

During the past four years instruction has been given on the etiology and prevention of postdecompression shock to Royal Australian Air Force aircrew, medical officers, civil aviation pilots, and to the personnel of the aviation medicine training courses who routinely pass through this school of aviation medicine.

Two papers have been presented on postdecompression shock, one[1] at the British Medical Association's Australasian Congress at Melbourne in 1952, and the other at the Far East Air Forces Command Surgeons' Conference at Nagoya, Japan, in 1955. The

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From Royal Australian Air Force School of Aviation Medicine, RAAF Base, Point Cook, Victoria, Australia.

Presented in part at the 28th annual meeting of the Aero Medical Association, Denver, Colorado, 7 May 1957.

former paper covered the general aspects of postdecompression shock and its treatment, and the latter was confined to the author's hypothesis and original researches referred to by the Director-General of Medical Services of the Royal Australian Air Force in his paper delivered at the Aero Medical Association 1954 meeting in Washington, D. C., and later published.[2]

## THE PROBLEM OF POSTDECOMPRESSION SHOCK

Deaths have been reported in America and England where the only known abnormal environmental change to which the subjects had recently been exposed was low ambient pressure during simulated or actual flight.[3-9] In these cases the clinical and postmortem findings have been consistent with neurocirculatory collapse due to delayed shock.

So far there has been no satisfactory hypothesis to explain the origin of postdecompression shock. Most of the work on decompression reactions in the past has been the investigation of the formation of gas bubbles in the blood stream and tissues on decompression. This has shed no light, however, on the mechanism of postdecompression shock and disappointingly little on the other forms of decompression sickness.

Of the existing theories, the most favored one is that it is a biochemical disturbance. When this disturbance reaches a threshold value, it sets off a trigger mechanism that initiates the development of secondary shock. This type of theory has been proposed to explain the mechanism of traumatic shock. It presupposes that apart from the cause, postdecompression shock is the same as any other form of secondary shock and therefore may be regarded as an injury.[10,11] The available clinical evidence indicates that the foregoing theory is probably true. Because the nature of the trigger mechanism postulated for traumatic shock has not been determined with any degree of certainty, it is not possible to discuss the origin of postdecompression shock any further by analogy.

During a study of diet in relation to intestinal pain due to gas formation, the author[12] was led to believe that an increase in the percentage of protein would decrease the other symptoms of decompression sickness. At a later period in his study, it appeared that a direct relationship existed between a reduced protein intake and the frequency and severity of postdecompression shock.[12] It was suggested that this would explain the rise in incidence of impending or actual collapse in such cases in postwar England. Cotes[13] has noted that the incidence of impending or actual collapse taken together over 610 decompression runs at 37,000 feet for one hour after ascent at the standard rate (that is, 3,000 feet per minute to 20,000 feet, 2,000 feet per minute to 30,000 feet, and 1,000 feet per minute to 37,000 feet) was 3.1 per cent for Royal Air Force wartime personnel, whereas the incidence of postwar decompression shock for 520 civilians and Royal Air Force personnel was 6.9 per cent.

This belief was supported by the postmortem records of fatalities that had occurred in America and England up to and including 1952. It had been observed that an obviously fatty liver had been a consistent finding.[12] This was demonstrated histologically in five American fatalities described by Haymaker and Davison,[5] and two English fatalities described by Sproull[9] and Cotes.[4,13] The available literature does not record the portmortem condition of the liver in the other three known postdecompression deaths. However, Sproull, commenting on the first recorded postflight death in which a fatty liver was demonstrated histologically and in which pulmonary edema was present, stated: "The remarkable resemblance of this case to the previous fatality will be noted. . . . In 1944, in the previous fatality, the postmortem picture was remarkably similar to that of the present case, the main difference being the more extensive exudation" [in the earlier case]. Sproull[9] also mentions "the fat embolism found in the fatal cases."

In Australia, where the protein intake has remained high throughout the period under consideration, no serious collapses or deaths have occurred that could be attributed to the effects of decompression and delayed reactions have been rare.

## THE AUSTRALIAN CASE OF POSTDECOMPRESSION SHOCK

The one known case of postdecompression shock that has occurred in Australia is most interesting.[12] The subject had lived in England on a lowered protein diet before his reaction. It was demonstrated by biopsy that the liver contained an excessive amount of fat. When this fat was removed by dietetic treatment and the liver shown to be normal by a further biopsy, the subject could be re-decompressed without showing any symptoms or signs of actual or impending collapse.

The details of this particular case follow. On 11 March 1953 at 2 p. m. a Lincoln aircraft had been at 35,000 feet for 35 minutes when the pilot noticed that his second pilot had become restless; his forehead was cold and clammy but his skin and nails were normal in color. All members of the crew had observed oxygen drill according to the instructions for flights at this altitude. After ten minutes, the second pilot stated that he did not feel well and that his vision was blurred. (The fields were restricted and he had double vision.) He did not complain of the "bends." Emergency oxygen was given without improvement and he asked to be flown back to the base. At 5,000 feet, he was better and apparently was normal soon after the plane landed. At 8 p. m. he was in the officers' mess when he stated that he felt sick. He was then taken to the hospital. On hospital admission, he was dyspneic, his skin was cold and cyanotic, and his blood pressure was 95/70 mm Hg. He was treated for collapse, observed for four hours, and then permitted to return to his quarters. It would appear that this officer suffered from a delayed reaction and that the nature of his condition was not recognized by the civilian hospital staff. There is no record of his pulse rate or of any neurological examination.

The patient was 35 years of age. He weighed 192 lbs and was 5 feet 9 inches tall. At the annual physical examination on 2 March 1953 his blood pressure was 120/80 mm Hg and the chest roentgenogram was reported as normal. He was assessed by the medical examiner as fit for full flying duties.

These clinical details were given to me during a routine visit to the hospital concerned. Later, at my suggestion, the patient volunteered to be investigated by the Clinical Research Unit of the Walter and Eliza Hall Institute of Medical Research, Royal Melbourne Hospital. On admission, a provisional diagnosis of fatty liver was made. His dietary history was obtained (table 1).

TABLE 1.

| Analysis of diet | | | | Nutrient requirements for male—medium activity* | |
|---|---|---|---|---|---|
| | In England | | In Australia | | |
| Calories | 3,900 | | 3,100 | Calories | 3,000 |
| Total protein | (12%) 121 gm | | (18%) 139 gm | Total protein | 87 gm |
| Animal protein | 60 gm | | 112 gm | Animal protein | 43 gm |
| Carbohydrate | (55%) 540 gm | | (32%) 250 gm | Carbohydrate | – |
| Fat | (33%) 143 gm | | (50%) 175 gm | Fat | – |
| Iron | 25 mg | | 21 mg | Iron | 12 mg |
| Calcium | 0.7 gm | | 0.7 gm | Calcium | 0.8 gm |
| Phosphorus | 1.7 gm | | 1.7 gm | Phosphorus | 1.5 gm |
| Vitamin A | 11,800 I. U.** | | 6,000 I. U. | Vitamin A | 5,000 I. U. |
| Thiamine | 1.4 mg | | 1.4 mg | Thiamine | 1.2 mg |
| Niacin | 24 mg | | 30 mg | Niacin | 12 mg |
| Riboflavin | 1.6 mg | | 2.0 mg | Riboflavin | 1.8 mg |
| Ascorbic acid | 160 mg | | 164 mg | Ascorbic acid | 20 mg |

*Source, British Medical Association, 1950.
**International units.

## Discussion

During the three years that the patient was stationed in England his diet was adequate according to the 1950 British Medical Association recommendations for nutrient requirements. The percentage of calories derived from carbohydrate, 55 per cent, was high while those derived from fat and protein were 33 per cent and 12 per cent respectively. The total protein intake was quite high but only half of this consisted of animal protein. The patient consumed very little milk or cheese and few eggs were available. Thus, calcium and riboflavin intake was below standard and methionine was not well supplied. During his last year in England the patient flew frequently to the Continent where American rations were often available. He was able to eat more high grade protein and considerably less carbohydrate.

The patient returned to Australia early in 1953 and for six weeks lived at home. Since then he has been stationed in South Australia. His diet has been very good and contains more protein and fat and less carbohydrate than previously; 18 per cent of the calories are derived from protein and his diet includes twice as much animal protein as it had in England; 50 per cent of the

calories are derived from fat and only 32 per cent from carbohydrate. His calcium intake is still lower than standard as he does not drink any milk, however, he consumes more cheese and eggs and the intake of methionine has improved. He believes that he averages about six glasses of beer (7 oz) daily. He states that this amount does not interfere with his meals. His meal pattern is not that of an alcoholic.

A liver biopsy (fig. 1) was performed on this patient 15 April 1953. The pathologist reported:

> The liver biopsy revealed areas of fatty accumulation interspaced with practically normal liver cells. However even in some of these there was a fine distribution of fat. The portal radicles were normal and there was no increase in fibrous tissue. The findings would be in keeping with the resolving stage of a fatty liver, such as is sometimes seen in malnutrition. However it is not diagnostic of this condition.

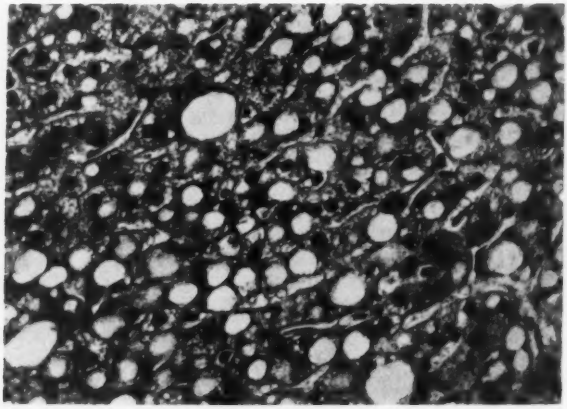

*Figure 1. First liver biopsy showing fatty infiltration. (× 250)*

The patient was given a diet chart and instructed to return to the hospital in ten weeks. He was readmitted on 1 July 1953. The dietitian reported that he had followed the dietary advice given him, during his previous visit to the hospital, and that his diet had been very good, with the lipotropic factors well supplied. He had not consumed any alcohol.

A second liver biopsy was performed on 1 July. Examination of this liver biopsy fragment (fig. 2) revealed that the tissue had regained its normal appearance. The pathologist reported:

> The liver architecture is normal, there is no increase of cells or fibrous tissue in the portal tracts, and the liver cells are regular and of normal size. The fatty change seen previously has now completely resolved.
> Liver—normal.

There was good evidence that the fatty change present at the first liver biopsy had resolved completely. The patient later was subjected to tests in the decompression chamber up to 37,000 feet and did not show any signs or have any symptoms that could be attributed to decompression sickness. He was returned to full flying duties. Subsequently, he has not had any recurrence of his trouble.

## EXPERIMENTAL WORK

To simulate the liver conditions found at postmortem in the fatal cases of postdecompression shock, the author carried out experiments with rats. Twelve albino rats were fed on a special

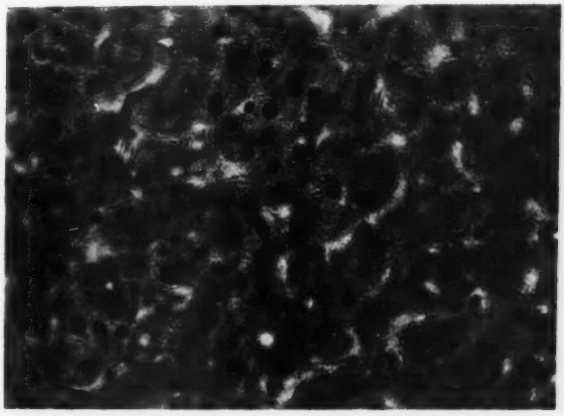

*Figure 2. Second liver biopsy showing normal liver. (× 250)*

diet the constituents of which were selected to keep the lipotrohic content to a minimum. This diet contained: beef dripping, 40 per cent; whole cracked wheat, 19.5 per cent; rolled oats, 19.5 per cent; corn meal, 19.5 per cent; and bone meal, 1.5 per cent. Because of its alipotropic action, small amounts of cystine were included. Two rats, that had been on this special diet for two months, were selected at random and sacrificed, one with ether and the other by trauma. Fresh liver from both rats was examined biochemically and specimens of liver, kidney and brain, as frozen, and paraffin sections from both were examined histologically.

In both cases, biochemical and histologic examination revealed a moderate degree of fatty infiltration in the liver, 9.9 per cent and 6.9 per cent lipids respectively. The fatty change in the liver in both cases was below the required level. It was concluded that the diet employed contained unwanted lipotrophic impurities. It was necessary to repeat the experiments with a diet free of these factors.

So that more adequate facilities would be available to carry out the necessary experimentation, it was arranged with the pathology department of the University of Melbourne, in collaboration with the author, to breed rats with the desired degree of fatty infiltration of the liver. The details of the diets and the technic followed are reported by Whiteside.[14]

Rats thus produced spontaneously developed fat embolism of the pulmonary bed, thus confirming the findings of Hartroft and Ridout;[15] moreover, when subject to nonhypoxic pressure altitudes above 30,000 feet, they showed more obvious pulmonary fat embolism. This, however, was not of a conclusive degree. Furthermore, the technical difficulties of subjecting small animals to a pressure altitude that is species-equivalent to the pressure altitudes experienced by human beings developing post-decompression shock, without hypoxic factors intervening, was appreciated. In addition, the reproduction or simulation of the human condition of patent foramen ovale in the rats, and other invalidating differences, such as hemodynamic factors, liver fat composition divergences, and body temperature, made the application of conclusions from work on small animals to man exposed to high altitude extraordinarily difficult.

Glynn and Himsworth[16] and Best, Hartroft, Lucas and Ridout[17,18] have shown the relationship of dietary deficiencies to the development of a fatty liver, in that the absence of choline and other lipotrophic factors in the protein fraction of the diet predisposes primarily to severe centrolobular deposition of fat, whereas in a general protein deficiency in the presence of adequate lipotrophic factors, thioamino acids and $\alpha$-tocopherol the deposition is periportal.

The relationship between fatty livers and fat embolism has been shown experimentally by Hartroft and Ridout.[15] In these cases the condition apparently developed spontaneously and did not appear to have caused the death of the animals. It is very easy to see how, if there should be mechanical variations in such a condition, a much grosser degree of fat embolism could result readily.

The unexplained presence of fat emboli, together with the finding of a fatty liver in the fatalities prior to and including 1952, led me to postulate that a causal relationship existed between these findings, and to offer a hypothesis in 1952. This hypothesis was strengthened later in 1953 by the biopsy findings in the Australian case discussed here.

Since the investigation of this case, there have been five further fatalities recorded after flight, two in England and three in America.[6-8] Further, of the 15 cases so far recorded, a patent foramen ovale has been demonstrated in three cases.[6,8] This condition appears not to have been sought in a large percentage of the remainder of the cases.

## THE HYPOTHESIS

It has long been recognized that for fat embolism to occur three essential conditions must coexist:[19] (1) free, fluid fat; (2) positive pressure greater than venous pressure, and (3) patent veins, with open ends that do not collapse. A fatty liver under decompression, ideally, should fulfill all three requirements.

*Free, fluid fat.* The temperature of the liver is higher than that of the body because of its greater metabolic activity. It may be assumed, therefore, that the liver fat would be less mobile if transferred to the general circulation.

*Positive pressure greater than venous pressure.* It is a classical finding that, with decompression, bubbles may form inside cells, not only of adipose tissue, but even of the liver and kidney, with consequent disruption of the cells.[20] Gersh and associates,[21] applying the frozen section technic, have demonstrated bubble formation inside the cells of fat tissue, with ensuing destruction of the cells.

For practical purposes the liver parenchyma may be regarded as subjected to "closed box" phenomena by virtue of the nondistensible nature of Glisson's capsule. Therefore, the liberation of dissolved gases from liver fat cells, particularly if centrolobular, must result in pressures that may cause their rupture with the extrusion of their fluid contents into the venous system.

*Patent veins, with open ends that do not collapse.* The sinusoidal system of the liver is supported at all times in a patent condition by a connective tissue stroma. In view of the above phenomena, it seemed reasonable to postulate a hypothesis embodying the sequence of events predisposing to certain cases of postdecompression shock, fatal or otherwise.

1. Dietetic deficiencies and indiscretions, such as excessive consumption of alcohol, may lead to centrolobular and periportal deposition of fat.

2. The liberation of dissolved gases within thin-walled hepatic fat cells, under conditions of low ambient pressure, may cause the rupture of the cell membranes and the release of the contents into the liver sinusoids. Once the fluid fat has been forced into the sinusoids it is carried by the blood stream to the capillaries of the lungs. The extent of the pulmonary embolism that arises is then dependent on the amount of fat that enters the blood stream and the length of time during which entry occurs. A large amount of fat forced rapidly into the sinusoids will produce the maximum effect whereas a small amount, especially if forced in slowly, may cause no symptoms whatever.

Harris[19] describes the situation as follows:

> It seems curious that such a normal constituent as fat can give rise to fatal embolism. Some consideration of the complex mechanism whereby it occurs is essential to a clear understanding

of the lesion. . . . Extensive pulmonary embolism with fat gives rise to a definite clinical picture, the outcome of which is often fatal. Obstruction of the pulmonary capillaries interferes with oxygenation of the blood; hence cyanosis is a prominent symptom. The peripheral blood pressure falls from failure of an adequate amount of blood to reach the left side of the heart. Damming back of the pulmonary circulation results in great dilatation and ultimate failure of the right side of the heart.

If the right side of the heart is sufficiently powerful it may force some of the fat emboli through the pulmonary capillaries into the peripheral circulation. . . . The resultant symptoms are dependent on the nature and importance of the organ involved. Cerebral embolism is the most common, most important and most serious manifestation. This occurs, naturally, at a time subsequent to the pulmonary manifestations and it also is often fatal.

Thus, from a consideration of the pathology of fat embolism it is evident that the lesion will manifest itself clinically in two principal ways, corresponding to the involvement of the lung and of the brain.

3. Should a septal defect such as a patent foramen ovale be present, it is easy to understand, with the lung involvement and consequent rise of pressure in the right side of the heart, how the fat emboli could pass directly to the brain,[22] producing the circulatory and central nervous signs and pyrexia which have been described.

4. The "lucid period" between the decompression and the onset of the symptoms and signs of postdecompression shock could be considered consistent with the characteristic "symptom-free interval" emphasized by Robb-Smith[23] in proven classical cases of fat embolism.

## THE LUCID INTERVAL

No explanation of the lucid interval has been advanced. It is suggested that it may in fact result from the delayed development of rising right intracardiac pressure, as a result of the gradual onset of the causative pulmonary edema. Until the differential pressure necessary for transcardiac transfer of fat-bearing blood develops, fat will not reach the brain by a previously nonfunctional patent foramen ovale. This differential pressure is of course not necessary for fat-bearing blood to reach the brain by pulmonary arteriovenous shunts. The presence of these shunts has been demonstrated by Tobin and Zariquiey.[24]

A third possibility has been suggested by Schneider.[25] He considered that the vertebral venous plexus could provide a bypass to the lung by which fat could reach the brain in much the same way as malignancy of breast and pelvis has been shown to metastasize to the cerebrum by this channel.

The incidence of persistent but nonfunctional patent foramen ovale is greater than is generally appreciated. Kjellberg and his associates[26] state: "In 20-25 per cent of individuals the fibrous fusion is never complete."

## DISCUSSION

Adler[3] has given a very detailed review of the clinical and postmortem findings in the seven American fatalities that occurred after exposure to low ambient pressure in decompression chambers prior to 1950. He states:

> In discussing an etiological mechanism of a clinical syndrome it seems to be always necessary, however unsatisfactory, to suspect that the 'biological individuality,' predisposing factors, or pre-existing pathology are responsible for some of the unusual reactions of individuals. Because most of the individuals in the military are in the younger age group and have had complete general and special medical examinations one or more times previously, it is understandable that very few instances of collapse at altitude should occur, since individuals with recognized medical conditions have been eliminated.
>
> The autopsy data on the seven known deaths associated with ascents to altitude in a low pressure chamber, reveal no significant lesions which were chronic or could have been interpreted as being major contributions or predisposing factors to the individuals' exodus.

This latter does not appear to be consistent with the postmortem findings in these cases, because a fatty liver is recorded in five cases and the condition of the liver is not mentioned in the other two cases.

Haymaker and Davison[5] state that, so far as they are aware, fat emboli have not been reported in caisson or diver's sickness, and, more recently, Haymaker and Johnston[27] state, "As far as we are aware, no one has previously looked for fat emboli in decompression to altitude or in diver's sickness or caisson sickness." Fat embolism in caisson sickness is well known in English literature. Muir's *Textbook of Pathology*[28] states that one of the causes of fat embolism is caisson sickness and illustrates an instance of it. Credit, however, is due to Haymaker and Johnston[27] for their painstaking researches in seeking fat emboli in the American deaths. Apart from a postflight fatality in 1952 assumed to be due to postdecompression shock, fat emboli were found in the remaining nine cases.

Of the five known English fatalities, fat embolism is recorded in only two.[7,8] It would appear that it was not sought in the remaining three fatalities, although in these cases there is postmortem evidence to indicate fat embolism was most probable, not only from the general postmortem picture but from such findings as: "There was cyanosis and congestion of the head and neck and there were a number of petechiae and ecchymoses over the right side of the chest and shoulders. . . . Petechiae were present on the front of the neck and shoulders. . . . Numerous recent sub-endocardial petechial haemorrhages were present on the walls of the left ventricle. . . . There were mild haemorrhages in the lepto-meninges."

Warthin[29] in his classical articles states "Petechiae of the skin are prone to occur over the chest, base of neck, upper extremities, and in the conjunctival sac, and their presence is an aid to the diagnosis of fat embolism. . . . Peri-cardial and pleural petechiae associated with the anoxia produced by the pulmonary embolism are of frequent occurrence." According to Warren:[30] "The classical picture is the appearance of small petechial haemorrhages in the leptomeninges as well as throughout the brain, and minute foci of softening scattered indiscriminately in the cortex and medulla."

An article in the *British Medical Journal*[31] on fat embolism states: "Of the physical signs, the most striking is the petechial rash which may develop over the upper chest, neck and shoulders, sometimes spreading to the arms and lower part of the trunk." In addition, petechiae have been reported by Benestad,[32] Busch,[33] Corlette,[34] Killian,[35] Schneider[25] and Whitaker.[36] The last-named author states "Petechial hemorrhages appeared on the skin of the neck, trunk, and upper extremities and the diagnosis of fat embolism was suggested."

Wilson and Salisbury[37] have stressed that while these petechiae are due to definite emboli that tend to slow down the general circulation, they are by no means a constant finding. Cotes[4] records one English fatality that occurred after a rapid decompression from 25,000 to 40,000 feet lasting four and a half seconds. This case is of interest in view of the postmortem findings in the victims of the 1954 Comet disasters.

Armstrong, Fryer, Stewart and Whittingham[38] state:

> The frozen sections revealed pulmonary fat embolism in twelve bodies. The amount was small in most cases, but in three it was considerable. The quantity of intravascular fat observed in the few frozen sections examined from each case does not, of course, necessarily indicate the total embolic fat-content of the lungs, and must, therefore, be interpreted with due reserve. However, the mere presence of fat embolism is of interest insofar as it might help to determine the sequence of injuries. It is unlikely that the fat originated within the lungs. Ante-mortem fractures are usually assumed to be the source of pulmonary fat-embolism, but this is not always so (Robb-Smith[39]). All twelve cases with which we are now concerned had fractures with local ante-mortem characteristics, but one case showing considerable fat embolism was also one of the only two bodies with an intact thoracic cage, having ante-mortem fractures only of the skull.
>
> The fat embolism suggests that the pulmonary circulation was maintained for a finite time after the cranial or thoracic fractures were sustained. In five of these bodies all the vessels forming the vascular peduncle of the heart (including the pulmonary arteries) were either extensively torn or completely severed. We, therefore, suggest that these injuries to the great vessels occurred a suf-

ficient time after the fractures for pulmonary fat embolism to develop, and that during this time the intrapulmonary vascular bed was also largely intact.

## PULMONARY EDEMA

In pulmonary fat embolism, the occlusion of large or small branches of the pulmonary artery or pulmonary capillaries leads inevitably to impairment of the endothelium and its supporting cells with increased endothelial permeability, so that large amounts of fluid may escape into the lungs. No sooner has an appreciable amount of the pulmonary circulation been impaired than partial local anoxia begins to develop. Infarction or necrosis of pulmonary tissue seldom occurs because, even in extreme pulmonary fat embolism, there is a sufficient degree of blood flow maintained by the bronchial arteries and uninvolved portion of the pulmonary tree to prevent actual cell death. However, focal or petechial hemorrhages may appear at regions of vascular occlusion. The localized anoxia that is induced leads to an increased permeability of the vascular and alveolar walls so that intravascular fluid escapes into the pulmonary tissues and alveoli. This edema may become exceedingly marked.

In 1863 Bergmann[40] noted that acute pulmonary edema was often associated with fat embolism and that inadequate emphasis had been placed on this observation. Warren[30] states "the occurrence of pulmonary edema in a case of recent trauma should lead to the suspicion of fat embolism," and Masland[41] observes that "the occurrence of pulmonary edema in a case of recent trauma should lead to the suspicion of fat embolism—of special interest is the existence of a period free from symptoms following the trauma in many cases." An article in the *British Medical Journal*[31] on fat embolism states "in the chest the signs are those of acute pulmonary oedema."

Apart from the one English, and the one American case for which no literature is available to the author, all the remaining cases are known to have shown marked pulmonary edema. In this connection the remarks of Burger[41] are of interest. He suggests that three forms of the pulmonary type of fat embolism may occur: (1) The hyperacute where death occurs in a few seconds; (2) The acute, in which the symptoms appear immediately after injury and death occurs in hours to days, and (3) The subacute, where a free period intervenes between the trauma and the onset of symptoms. The latter two modes of onset have been characteristic of postdecompression shock (fig. 3).

## OTHER FINDINGS

The high temperatures that have been recorded in fatal cases of postdecompression shock are consistent with the classical findings of Hamig,[42] Warren,[30] and Winkelmann[43] that "a rapid rise in temperature without evidences of pneumonia suggests that the brain has been involved in an embolic process."

It is significant that, in all the fatal cases of postdecompression shock, the syndrome has progressed to its termination despite the institution of diverse specific therapeutic measures. In classical cases of fat embolism, the failure of therapy has long been recognized.

It has been a characteristic in most cases of postdecompression shock, fatal or otherwise, that the individuals concerned did not attain altitudes much above 30,000 feet. Several authors have commented on this fact. Sproull[9] in his description of the first recorded fatal collapse after flight states: "A secondary question is the riddle of why the fatality occurred in an experienced high altitude flier at such a relatively low altitude."

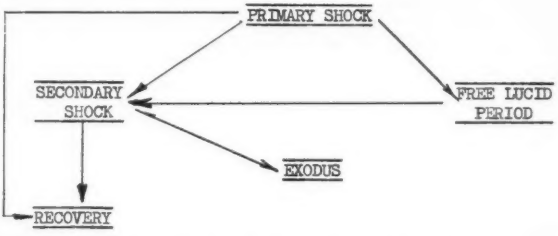


*Figure 3. Schematic clinical course of postdecompression shock cases.*

The correlation of these findings with the original demonstration by Armstrong[44] of the formation of nitrogen bubbles in the blood stream beginning at 30,000 feet, or at about one-quarter atmosphere, appears to the author to be most significant. This, in association with the fact that the degree of decompression experienced by the subjects in most cases discussed, strongly supports the author's contention in that fat is liberated into the blood stream as a result of a disruptive generation of gas within fat containing liver cells. This close approximation of the two phenomena surely would appear to be beyond the bounds of coincidence.

*The liver fat.* Several authors including Warren[30] have stressed that the nature of the fat-producing embolism is of greater importance than the actual quantity. Franks[45] elaborating this view stressed the possible importance of fatty acids and suggested that the mortality from fat embolism may be due to the splitting of neutral fats into fatty acids and glycerols by enzymes. He cited the result of the experimental injection of unstable fatty acids into rabbits that resulted in rapid death, with postmortem evidence of hydrolysis of the neutral fat.

Although detailed discussion of this aspect is beyond the scope of this article, it is to be noted in passing that fat breakdown normally occurs intracellularly and that perhaps when it occurs extracellularly toxic products are formed.

Hepatic fat cells differ from somatic fat cells in that: (1) The histologic appearance of the membranes of liver fat cells suggests a greater degree of fragility; and (2) The fat contained in the cells is of a more unsaturated type and has a lower melting point.

Of the 15 recorded postdecompression deaths, the first 8 occurred after decompression in decompression chambers, whereas the majority of the remaining cases, actually all but one, followed decompression in actual flight. It is postulated that the most significant factor in this change of incidence may be the greater awareness exercised in recent years in the supervision of decompression runs in chambers.

## SUMMARY

In the past 14 years, 15 deaths have occurred following decompression, 9 of these have been after chamber runs and 6 after actual flight. It is suggested that all the fatalities have been due to fat embolism as a result of exposure to low ambient pressure. A nonfatal Australian case of postdecompression shock has been investigated and the findings are correlated with the available information on the fatal cases.

The hypothesis is advanced that the cause of death in the fatal cases, and the cause of shock in the nonfatal cases was embolization of liver fat to lungs and brain under changed circumstances of differential pressure applied to the liver. It is postulated that fat may reach the end-arteries of the brain by arteriovenous shunts in the lungs, by a patent foramen ovale or by the vertebral venous plexus. The management of the nonfatal Australian case and Australian research into the experimental production of fatty livers in animals and the results of decompression of these is reviewed briefly.

## REFERENCES

1. Rait, W. L.: Post-decompression shock. *Med. J. Aust.* 2: 533-534, Oct. 11, 1952.

2. Daley, E. A.: Aviation medicine progress in Australia over 25 years. *J. Aviation Med.* 25: 451-456, Oct. 1954.

3. Adler, H. F.: Neurocirculatory Collapse at Altitude, Special Project, U. S. Air Force, School of Aviation Medicine, Randolph Air Force Base, Tex., June 1950. pp. 10-14.

4. Cotes, J. E.: Decompression sickness with post-decompression collapse. R. A. F., F. P. R. C. Report no. 825, Apr. 1953.

5. Haymaker, W., and Davison, C.: Fatalities resulting from exposure to simulated high altitudes in decompression chambers; clinicopathologic study of 5 cases. *J. Neuropath. & Exper. Neurol.* 9: 29-59, Jan. 1950.

6. Haymaker, W.; Johnston, A. D.; and Downey, V. M.: Fatal decompression sickness during jet aircraft flight; clinicopathological study of 2 cases. *J. Aviation Med.* 27: 2-17, Feb. 1956.

7. Mason, J. K.: Aviation pathology. R. A. F. Report no. 1, Nov. 1955.

8. Mason, J. K., and Fryer, D. I.: Aviation pathology. R. A. F. Report no. 2, Apr. 1956.

9. Sproull, D. H.: Report of a fatality following exposure to high altitude, with a review of the pathological aspects of decompression sickness. RAF Inst. Av. Med. F. P. R. C., Memo 25, Apr. 1951.

10. Romano, J., and others: Syncopal reactions during simulated exposure to high altitude in decompression chamber. *War Med.* 4: 475-489, Nov. 1943.

11. Masland, R. L.: Injury to central nervous system resulting from decompression to simulated high altitudes. *Arch. Neurol. & Psychiat.* 59: 445-456, Apr. 1948.

12. Rait, W. L.: In reports of R. A. A. F., 1949-1953.

13. Cotes, J. E.: Notes on incidence of cases of collapse in R. A. F. decompression chambers. RAF. *Inst. Av. Med.* F. P. R. C. Memo 33, Mar. 1952.

14. Whiteside, M. G.: Development of diffuse nutritional fibrosis in liver of rats. *Australasian Ann. Med.* 5: 294-304, Nov. 1956.

15. Hartroft, W. S., and Ridout, J. H.: Pathogenesis of cirrhosis produced by choline deficiency; escape of lipid from fatty hepatic cysts into biliary and vascular systems. *Am. J. Path.* 27: 951-989, Nov.-Dec. 1951.

16. Glynn, L. E., and Himsworth, H. P.: Massive hepatic necrosis of liver: its significance and experimental production. *J. Path. & Bact.* 56: 297-305, July 1944.

17. Best, C. H.; Hartroft, W. S.; Lucas, C. C.; and Ridout, J. H.: Liver damage produced by feeding alcohol or sugar and its prevention by choline. *Brit. M. J.* 2: 1001-1006, Nov. 5, 1949.

18. Best, C. H.; Hartroft, W. S.; Lucas, C. C.; Ridout, J. H.: Effects of dietary protein, lipotropic factors, and re-alimentation on total hepatic lipids and their distribution. *Brit. M. J.* 1: 1439-1444, June 18, 1955.

19. Harris, R. I.: Fat embolism. *J. A. M. A.* 105: 1013-1016, Sept. 28, 1935.

20. Hill, L.: *Caisson Sickness and the Physiology of work in Compressed Air.* Edward Arnold, xi, London, Engl., 1912. pp. 164-177.

21. Gersh, I.: Hawkinson, G. E.; and Ratbun, E. N.: Tissue and vascular bubbles after decompression from high pressure atmospheres—correlation of specific gravity with morphological changes. *J Cell. & Comp. Physiol.* 24: 35-70, Aug. 1944.

22. Vance, B. M.: Significance of fat embolism. *Arch. Surg.* 23: 426-465, Sept. 1931.

23. Robb-Smith, A. H. T.: Pulmonary fat-embolism. *Lancet* 1: 135-141, Feb. 1941.

24. Tobin, C. E., and Zariquiey, M. O.: Arteriovenous shunts in human lung. *Proc. Soc. Exper. Biol. & Med.* 75: 827-829, Dec. 1950.

25. Schneider, R. C.: Fat embolism; problem in differential diagnosis of craniocerebral trauma. *J. Neurosurg.* 9: 1-14, Jan. 1952.

26. Kjellberg, S. R., Mannheimer, E., Rudhe, U., and Jonsson, B.: *Diagnosis of Congenital Heart Disease.* Year Book Publishers, Chicago, Ill., 1955. p. 24.

27. Haymaker, W., and Johnston, A. D.: Pathology of decompression sickness. In *Collected Papers of the Armed Forces Institute of Pathology.* A. F. I. P., Washington, D. C., 1955. pp. 285-306.

28. Muir, R.: *Textbook of Pathology.* 5th edition. Williams & Wilkins Company, Baltimore, Md., 1941. pp. 41-42.

29. Warthin, A. S.: Traumatic lipemia and fatty embolism. *Internat. Clinics* 4: 171-227. Dec. 1913.

30. Warren, S.: Fat embolism. *Am. J. Path.* 22: 69-87, Jan. 1946.

31. Fat embolism. *Brit. M. J.* 2: 897, June 19, 1954.

32. Benestad, G.: Drei Falle von Fettembolie mit punkt Formigen Blutungen in der Haut. *Dtsch. Z. Chir.* 112: 194-205, Oct. 1911.

33. Busch, F.: Ueber Fettembolie. *Virchows Arch.* 35: 321-358, Feb. 1866.

34. Corlette, C. E.: Cerebral fat embolism. report on case with recovery. *M. J. Australia*, 1: 229-234, Mar. 7, 1925.

35. Killian, H.: Die traumatische Fettembolie. *Deutsche Ztschr. f. Chir.* 231: 97-186. 1931.

36. Whitaker, J. C.: Traumatic fat embolism; report of 2 cases with recovery. *Arch. Surg.* 39: 182-189, Aug. 1939.

37. Wilson, J. V. and Salisbury, C. V.: Fat embolism in war surgery. *Brit. J. Surg.* 31: 384-392, Apr. 1944.

38. Armstrong, J. A.; Fryer, D. I.; and Stewart, W. K.; and Whittingham, H. E.: Interpretation of injuries in Comet aircraft disasters; experimental approach. *Lancet* 1: 1135-1144, June 4, 1955.

39. Robb-Smith, A. H. T., Hunt, A. H.; Russell, D.; and Greenfield, G. G.: Discussion on fat embolism and brain. *Proc. Roy. Soc. Med.* 34: 639-656, Aug. 1941.

40. Bergmann, E. B.: Tur Lehre von der Fettembolie. Kaiserlichen Universitat Dorpat. E. J. Karow, Dorpat, Germany, 1863. p. 41.

41. Bürger, L.: Die Bedeutung der Fettembolie fur den Driegschirurgen. *Med. Klinik* 11: 996-1001, Sept. 5, 1915.

42. Hamig, G.: Ueber die Fettembolie des Gehirns. Nach klinischen Beobachtungen. *Beitr. klin. Cher.* 27: 333-362, 1900.
43. Winkelmann, N. W.: Cerebral fat embolism; clinicopathologic study of 2 cases. *Arch. Neurol. Psychiat.* 47: 57-76, Jan. 1942.
44. Armstrong, H. G.: *Principles and Practice of Aviation Medicine.* 3d edition. Williams & Wilkins Company, Baltimore, Md., 1952. pp. 315-318.
45. Franks, W. R.: Minutes of meeting, Inst. Av. Med. R. C. A. F., Jan., 1956.

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## A TERRELLA FOR TWO—OR THREE

The coming penetration of the extra-atmospheric regions of the vacuum of space makes the study of synthetic simulated atmospheres in a closed system urgent. Moreover, the possibility of an eventual approach to other celestial bodies in the not too distant future requires a careful examination of the ecological qualities of their atmospheres in advance. The physics of our natural atmosphere and its biological functions are known to us. But what is not generally realized is the fact that our atmospheres, with respect to the life supporting elements, represents a closed ecological system on a gigantic scale. It is sealed off from the surrounding vacuum of space by the earth's gravitational attraction. Only lighter elements such as hydrogen and helium, if they reach the critical kinetic energy level, can escape into space. In fact, the high leakage rate concerning these latter elements is responsible for the shift of the chemical composition from the lighter protoatmosphere dominated by hydrogen and hydrogen compounds, which existed some two billion years ago, to the heavier present-day atmosphere in which the elements nitrogen and oxygen prevail. Our planet "Terra" with its gravitationally sealed off atmosphere is a giant space ship with 2.8 billion occupants revolving with an orbital velocity of 18.6 miles per second around the sun. And what we must do, if we leave this mother space ship, is to simulate in a closed compartment all the life-supporting and life-protecting atmospheric functions insofar as this is possible. In other words, we must create for the two or three space travelers a little earth—a terrella—which, of course, has no gravity of its own. Such manned sealed gondolas with simulated atmosphere have been flown high into the space equivalent regions of the atmosphere in balloons, and rockets have carried animals in climatized compartments still higher and even in an orbit.—Hubertus Strughold: Exotic Atmospheres on Earth. In symposium: Simulated Atmospheres and Foreign Environments in Space Operations. *Journal of Aviation Medicine,* May 1959.

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# PRINCIPLES AND PRACTICE OF TOPICAL ANTIMICROBIAL THERAPY

EDWIN J. PULASKI, *Colonel, MC, USA*

THE most notable developments of the past decade in antimicrobial therapy came about as a result of their systemic need and use. Topical medications followed, with varying degrees of success and general acceptance. Sufficient knowledge and experience has now accumulated so that local therapy may be used along rational lines. This development has been due in part to the introduction of new and important antimicrobial agents. More importantly, it is the result of critical controlled studies pointing to the more intelligent use of these and of older drugs.[1-6] Principles of antimicrobial therapy and, as a logical extension, their application to treatment as well as prevention of infections of wounds, skin, and mucous membranes are discussed here.

## PRINCIPLES

If topical antibiotic therapy is to succeed, the following factors in the wound detrimental to antibiotic activity must be considered: the type of underlying pathologic lesion, biologic materials which inactivate the drug, unfavorable pH, the low metabolic turnover of the micro-organisms, and the intracellular location of the micro-organisms. In addition, the allergenic potentialities of the antibiotic or the vehicle which delivers it may be the limiting factor. For such therapy to succeed certain conditions must be fulfilled, and it is easy to illustrate failure due to lack of their observance on the part of the physician. The chief of these principles are the following: Accurate etiologic diagnosis; accessible lesion; sound surgery and competent nursing care; drug-sensitive micro-organisms; and a nonallergenic, noncytotoxic preparation.

**Accurate Diagnosis.** The important considerations in diagnosis are whether infection is present, whether it is primary or secondary, and whether it is superficial or deep.

Diagnosis of infection initially is clinical and is based on etiologic probabilities, and the therapeutic agent is selected accordingly. If the lesion is superficial, treatment is usually

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From Letterman Army Hospital, San Francisco, Calif.

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effective. Nevertheless, laboratory studies at the beginning of empiric therapy are desirable, even mandatory, for staphylococcal and mixed and deep infections.

It must be appreciated that cultures of wound exudates positive for bacteria do not necessarily indicate bacterial disease. The first problem is clearly to distinguish between primary and secondary infections.

| Primary infection | Secondary infection |
|---|---|
| Involves normal tissues | Involves diseased tissues |
| Usually is monobacterial | Pure or mixed infection |
| Usually is acute | Acute or chronic |
| Diagnosis is readily made | Differential diagnosis is complex |
| Early treatment is curative | Result of treatment is unpredictable |

*Primary infections* originate in previously healthy tissues. They usually are incited by a single species of pathogenic micro-organism. Early adequate antimicrobial therapy and good nursing care effect a prompt and complete cure in most instances.

*Secondary infection* develops in a variety of pre-existing disturbances such as eczemas, eruptions caused by drugs, insect bites, sinuses and fistulas, wounds, burns, and ulcers. The offending micro-organisms when rapidly proliferating play a prominent role in protracting or intensifying it. Early recognition is not always easy. It is the host response which differentiates contamination from infection. If a stained smear preparation of the exudate reveals neutrophils and bacteria, a diagnosis of infection is tenable. If the infection is deep or chronic, diagnosis may require culture or biopsy, with appropriate histologic, bacteriologic, and mycotic examinations. Treatment of the infection itself does not necessarily result in cure. Bacteriologic control may bring about improvement, although there is still the underlying disease. On theoretical grounds, an acute lesion should respond better to all-inclusive local therapy than a chronic lesion, and actually this usually happens.

**Accessible Lesion.** Topical therapy can succeed only in superficial or mucosal lesions or in body cavities where the drug can flood the whole of the infected area. If deep penetration has occurred, or if the lesion, such as a 50 per cent body surface burn, is too extensive, the systemic route is preferable to the topical. Other causes of failure include loculations within cavities; fibrosis which impedes free permeation of drugs as in sinuses, fistulas, and other old exudative lesions; and the presence of sloughs, necrosed bone, or other nonviable tissues or foreign bodies. Undrained or inadequately drained and debrided infections are unsuitable for topical therapy.

**Sound Surgery, Good Nursing Care.** The chief aim of topical therapy is to secure persistence of effect with repeated but widely spaced applications. This aim is achieved only by pro-

viding adequate contact between drug and microbe as well as providing optimal conditions for wound repair. Crusts must be removed, adequate drainage provided, and devitalized tissues and foreign bodies removed, according to the dictates of sound surgical principles. Suitable dressings are applied as indicated.

Of considerable interest and concern is the emergence, especially in the hospital environment, of micro-organisms resistant to several antibiotics. Indiscriminate, casual, and prolonged topical use of antibiotics may be an important contributory factor. Inasmuch as lesions suitable for topical therapy are often "open" lesions, carelessness in dressings technics and in disposal of infected dressings invites widespread environmental dissemination, as well as colonization of skin and mucous membranes of patients and personnel. It is, of course, possible by means of a well-planned program to reduce this environmental contamination. The substitution of newer antibiotics for the older ones does not solve the problem of cross infections.

**Suitable Topical Antibiotics.** Suitable antimicrobials are bacitracin, chloramphenicol, neomycin, polymixin, and tetracycline. Antimycotic agents are nystatin and amphotericin. The majority of superficial pyogenic infections will respond to a single antimicrobial preparation. There has been a great trend on the part of pharmaceutical manufacturers to develop combinations of of drugs for the treatment of local resistant infections. Bacteriologic studies have revealed that these prefabricated combinations are seldom the selections necessary, because refractory strains present a variety of resistance patterns.

The reactions to topical antibiotics are in general similar to those appearing after the use of systemic antibiotics. These reactions include, chiefly, sensitivity and the development of local organism resistance. The development of damage to viscera or particularly to liver, kidneys, and blood is not too likely an occurrence even when used over extensive surface areas.

One popular phase of combined topical antibiotics today is the use of various corticosteroids in combination with an antibiotic, especially neomycin and, less commonly, chloramphenicol and nystatin. Again, in spite of the popular use of these combinations, there are surprisingly few good controlled studies of the bacteriology and mycology of such lesions, or even the actual role of topical corticosteroid on the organism. This is then another neglected field in the study of the mechanism of topical corticosteroid activity. There is, however, increasing use of corticosteroids combined with chemotherapeutic agents for superficial local infections. The reasoning is that one has greater security of conscience, if not knowledge, when this combination is used in local allergic reactions, whenever the skin is subject to actual or potential local infection. When there is local infection or when it threatens, certainly corticosteroids and chemotherapeutic agents can be used in effective combina-

tion. It is interesting nevertheless that in local eczematous reactions, produced by topical applications of neomycin, the protective influence of the associated corticosteroids is nil, for the inflammatory allergic reaction is too severe for the local corticosteroid to be influential.

**Synthetic Topical Chemotherapeutic Agents.** Some of the commonly used synthetics are acridines, monoxychlorosene (Clorpactin WCS-90), gentian violet, hexachlorophenes, iodophors, nitrofurans, quaternaries, sulfacetamide, chlorquinaldol (Sterosan), iodochlorhydroxquin (Vioform), bismuth tribromphenate (Xeroform), zinc peroxide, and Burrow's solution.

It is well to remember that, except perhaps in superficial monilial infections and in superficial infections of the Pseudomonas group, certain topical chemotherapeutic agents which remain effective in the presence of blood, body fluid and pus do act as effectively as topical antibiotics. The more important of these chemical compounds include chlorquinaldol, iodochlorhydroxyquin, Burrow's solution, and Furacin (brand of nitrofurazone). A variety of chemical agents also are available for topical use in superficial fungal infections. The real value of topical chemotherapeutic agents is that they avoid sensitization of the patient to antibiotics which may be required later for systemic therapy in much more significant infections. Moreover, the use of chemical agents obviously prevents the development of organism resistance to the antibiotics. This is of considerable concern now in hospital infections, cross infections of wounds, and the intestinal flora of carriers.

## PRINCIPAL INDICATIONS FOR TOPICAL ANTIMICROBIAL THERAPY

The principal indications for topical antimicrobial therapy are: (1) superficial drug-susceptible pyogenic, Pseudomonas, yeast or mycotic infections; (2) infections of the tracheobronchial tree, pleura, and joints; and (3) prevention of local infections.

**Superficial Drug-Susceptible Pyogenic, Pseudomonas, Yeast or Mycotic Infections.** Nonsensitizing synthetic chemotherapeutic agents are substituted for antibiotics for staphylococcal and streptococcal infections where such agents are of proven clinical effectiveness. Antibiotic therapy is required in the Pseudomonas and for local proved monilial and mycotic infections. Antibiotic therapy is reserved for pyogenic infections when bacteriologic studies show that the organism is sensitive to the antibiotic and topical chemotherapy has failed.

**Infections of the Tracheobronchial Tree, Pleura, and Joints.** These are preferably treated with a suitable antibiotic. Mucosal lesions such as thrush or intraenteric infections may be treated with either antibiotic or chemotherapeutic agent, whichever is more effective or available.

**Prevention.** Prevention of local infection perhaps may be the most important of all forms of local antimicrobial therapy. As

examples, prevention of ophthalmia neonatorum, aerosol sprays for infections of the tracheobronchial tree, clearing of freshly contaminated burn wounds of hemolytic streptococci, protection of donor sites from infection from the burn wound, and prevention of anastomotic leaks following colon surgery by preoperative suppression of the flora of the large bowel, have been repeatedly demonstrated. Applications of solutions of antibiotics to wound surfaces following surgical intervention in contaminated fields now also shows promise of being highly efficacious in prevention of postoperative wound suppurations. Postoperative prevention of dissemination of cancer cells by means of topical chemotherapy is now in the stage of clinical investigation. No such applications, however, can substitute for gentle, deft surgery and avoidance of wound-healing faults and superinfections. Topical therapy without justification or design is ritualistic and what drug is used does not matter a great deal.

## SUMMARY

Topical antibacterial therapy, in order to be successful, is no easy matter. For such therapy to succeed certain conditions must be fulfilled. The chief of these principles are accurate diagnosis; accessible lesion; sound surgery and nursing care; drug-sensitive microbes; and the diligent use of a nonallergic, noncytotoxic preparation. Some important indications for topical antimicrobial therapy are outlined.

## REFERENCES

1. Garrod, L. P.: Principles and practice of local chemotherapy. *Brit. M. Bull.* 4: 275-280, 1946.

2. Howe, C. W., and Wigglesworth, W. C.: Control of infections associated with obliterative arterial disease. *Surg., Gynec. & Obst.* 96: 553-563, May 1953.

3. Pulaski, E. J.: *Surgical Infections: Prophylaxis, Treatment, Antibiotic Therapy.* Charles C Thomas, Publisher, Springfield, Ill., 1954. Chapter 1.

4. Liedberg, N. C. F.; Reiss, E.; Kuhn, L. R.; Amspacher, W. H.; and Artz, C. P.: Infection in burns; evaluation of local use of chloramphenicol ointment and furacin soluble dressings on granulating surfaces following extensive full thickness burns. *Surg., Gynec. & Obst.* 100: 219-231, Feb. 1955.

5. Metzger, W. I., and Prigot, A.: Effect of local antibiotic therapy upon survival of wound bacteria. *Antibiotics & Chemother.* 5: 423-432, Aug. 1955.

6. Vaughn, A. M.; Glover, W. J.; Martin, G.; Annan, C. M.; and Caserta, J. A.: New antibiotic combination for topical use in surgery; preliminary report. *Postgrad. Med.* 21: 255-258, Mar. 1957.

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We doctors, while we still retain that measure of control over our practices allowed us by the inspired popular clamor of patients to be dosed, must make the decision whether to give up all along the line and merely hand out the pills, or not. No individual can *dictate* that decision, but I shall here attempt to *influence* it by saying this much: All drugs—even the very best and least noxious of them—are, psychologically or physically, potentially toxic agents; and none of them should be used unless such use cannot reasonably be avoided—Harry Beckman: Must All the Drugs Be Used? *Wisconsin Medical Journal*, March 1959.

# ADMINISTRATION OF INTRAVENOUS FAT EMULSION TO SURGICAL PATIENTS

EDWARD R. NELL, *Captain, MC, USN*
MARVIN L. GERBER, *Captain, MC, USN*

PATIENTS in whom normal alimentation has been interrupted by disease or by surgery undergo rapid depletion of the body storage depots of fat and protein. Surgeons, as well as other clinicians, have recognized for many years the need of a high caloric material which could be administered parenterally to such patients. Loss of body weight occurs despite continuous maximal administration of solutions of carbohydrates and protein hydrolysates. The absolute amount of such caloric sources that may be safely administered during any 24-hour period is limited to an inadequate level by the considerable amount of water that must accompany them as a vehicle. Fat, because of its high caloric content per unit of weight, is the obvious ideal substance to provide a maximum of calories with a minimum volume of the necessary aqueous vehicle.

Clinical and laboratory investigators have repeatedly attempted to find a practical solution to this problem for the past 40 years. Failure was consistently experienced because of the unacceptably high incidence of serious systemic reactions caused by toxicity of the emulsifying agents used. Recent work has resulted in the elimination of the toxic fractions of suitable emulsifiers and in the synthesis of nonionic, nonhemolytic coemulsifiers. Subsequent laboratory and clinical testing of lipid emulsions containing such nontoxic emulsifying agents determined that they could be safely stored and used for short periods of time under clinical conditions.

This study was initiated to afford the surgical staff of this hospital experience in the administration of intravenous fat to surgical patients. A commercially available lipid emulsion, Lipomul I. V.,* was chosen which had already received adequate laboratory testing and trials and limited clinical trial. It contains fat particles, the majority of which are less than 1 micron in diameter.[1] It may be successfully stored for one year under

From U. S. Naval Hospital, Oakland, Calif.

*Furnished by the Upjohn Company, Kalamazoo, Mich. Lipomul I. V. is available commercially in 600-ml sterile bottles containing 500 ml of 15 per cent fat emulsion.

refrigeration. The presence of visible oil droplets, however, means that the emulsion has broken down and should not be used. It was supplied in bottles containing 600 ml,* representing a caloric content of 960.

The indications for its use exist whenever parenteral alimentation, in whole or in part, must be relied upon as a source of calories. It represents a high caloric source for use in conjunction with glucose, amino acids, electrolytes, and vitamins. However, it should not be mixed with them or with blood transfusions or given simultaneously or through the same tubing, because the lipid emulsion may be broken down. It makes it possible for the patient to conserve nitrogen and in some cases may enable the surgeon to convert a negative to a positive nitrogen balance. It is not usually necessary in the immediate postoperative period, of course.

During the past two years, 187 units of Lipomul of 600 ml each were administered to 69 surgical patients of all types and all ages. No adequate biochemical studies were performed on the majority of these cases. The temperature, pulse, blood pressure, and subjective reactions were followed and recorded, however. Thirty-five of the patients received only one bottle each. Of the remaining 34 patients who received more than 1 unit, 4 received more than 10 units each.

TABLE 1. *Over-all incidence of side effects of Lipomul I. V.*

| Reaction | Signs and Symptoms | Incidence | |
|---|---|---|---|
| Major | | | |
| Immediate | Urticaria | (2) | |
| | Chest pain | (1) | 3 |
| Delayed | Chill | | 4 |
| Minor | Fever (2°F or more) | | 15 |
| | Other (nausea and vomiting) | | 2 |
| Total | | | 24 |

The clinical investigators in this field[2-5] classified side effects from the administration of such lipid infusions as major[6] and minor. Those of major character may be of the immediate or "colloid" type, and consist principally of chest or back pain, dyspnea, flushing, or urticaria, usually manifest after only a few milliliters have been administered. The delayed major reaction is a chill, usually occurring during infusion but may be delayed a few hours. The minor reactions usually consist of mild temporary fever, or of such symptoms as nausea, vomiting, abdominal discomfort, headache, and dizziness. There may be variations in blood pres-

sure or pulse. The over-all incidence of side effects in our series is shown in table 1.

Mild temporary fever was obviously the most common side effect, and perhaps merits closer scrutiny. Accordingly, the cases have been broken down into those with 1.5°F temperature elevation, of which there were 24; and those with more than 2.0°F elevation, totaling 15 cases. The fever characteristically appeared toward the end of the infusion and disappeared after a few hours.

## CASE REPORTS

Data on the four patients who received more than 10 units of Lipomul each follow.

*Case 1.* This 48-year-old woman weighed about 80 pounds and she had the clinical picture of cachexia at the time a bowel resection was performed for regional enteritis. She received 16 bottles of Lipomul intravenously over a 2-month period, most of it being administered during the postoperative period. She experienced a transient chill at the termination of the second unit of Lipomul, with a temperature elevation of 1.2°F. On three other occasions there were temperature elevations of 2°F or more, but without chills or other side effects. It is our belief that the preoperative preparation and postoperative care were materially enhanced by the use of 16 units of intravenous fat, totaling 15,360 calories.

*Case 2.* This 73-year-old man received 11 units of Lipomul I. V. over a period of 11 days. Resection of the distal esophagus and cardia was performed for ulcerative esophagitis and stricture secondary to hiatal hernia and peptic esophagitis. He experienced transitory chest pain about two hours after the beginning of the second unit and had a concomitant tachycardia of 130, with blood pressure of 160/100 mm Hg. The infusion was temporarily discontinued, then cautiously restarted after about an hour and a half, at which time the pulse rate was 110 per minute and the blood pressure 140/100 mm Hg. No further side effect appeared. Pyrexia of 2.2°F with the ninth unit, and 2.4°F with the eleventh, was recorded and was manifest at the time each infusion was completed.

*Case 3.* This 43-year-old man received 12 units of Lipomul I. V. over a 3-month period, but 9 of them were given during a 12-day period. A gastric resection for intractable duodenal ulcer was carried out, followed about 2 months later by a laparotomy for intestinal obstruction. The patient had a temperature elevation of 2.2°F during administration of the first bottle and toward the close of the sixth.

*Case 4.* This 29-year-old woman received 11 units of Lipomul I. V. over a 6-month period, the first 4 over a period of 2 weeks, and the last 7 over another period of 2 weeks. She underwent several major surgical procedures during the 6-month period, all directed toward the treatment

of chronic pancreatitis. One major reaction, urticaria, was experienced immediately after completion of the second unit, with associated tachycardia of 122, which was relieved immediately by administration of a standard antihistamine. The patient had a transient hill, without fever, about 30 minutes after completion of the third unit.

## SUMMARY

One hundred and eighty-seven units of lipid emulsion (Lipomul I. V.) were given by intravenous infusion to 69 patients on the surgical service of this hospital. No significant complication was attributed to its administration. This experience with intravenously administered fat emulsion indicates that the immediate reactions are of a mild nature and not sufficiently severe to preclude its clinical utilization over limited periods of time.

## REFERENCES

1. *Lipomul-I. V. (Upjohn) 11,612 Series,* revised May 31, 1957, The Upjohn Company, Kalamazoo, Mich., 1957.

2. Smith, M. E.: Symposium on intravenous fat emulsion; Clinical studies on intravenous fat. *Metabolism* 6 Part 2: 717-722, Nov. 1957.

3. Preston, F. W.; Barnes, A. U.; Mandel, E. E.; Staley, C. J.; and Trippel, O. H.: Symposium on intravenous fat emulsion; Effects of repeated infusions of fat emulsion in surgical patients. *Metabolism* 6 Part 2: 758-765, Nov. 1957.

4. Levenson, S. M.; Upjohn, H. L.; and Sheehy, T. W.: Symposium on intravenous fat emulsion; Two severe reactions following long-term infusion of large amounts of intravenous fat emulsion. *Metabolism* 6 Part 2: 807-814, Nov. 1957.

5. Bozian, R. C.; Davidson, N. W.; Stutman, L. J.; and Wilkinson, C. F., Jr.: Symposium on intravenous fat emulsion; Observations on use of intravenous fat emulsions in man. *Metabolism* 6 Part 2: 703-716, Nov. 1957.

6. Watkin, D. M.: Symposium on intravenous fat emulsion; Clinical, chemical, hematologic and anatomic changes accompanying repeated intravenous administration of fat emulsion to man. *Metabolism* 6 Part 2: 785-806, Nov. 1957.

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## SPOILED STATISTICS

One of our greatest faults as statisticians is to demand expert information from those who cannot possibly furnish a true answer, except by accident. If our unfortunate informant happens to be honest and admits he does not know, we insist on his making a guess, which he eventually does. Our most haunting fear is that we may have to classify a cause of death as "unknown or ill-defined"—rather than this we would accept almost any random conjecture. Then we proceed to roll this speculation into one ball with information secured at highly reliable levels and push the resulting mess into one pigeonhole, apparently with the idea that the certainty of part of the number will permeate the remainder. It is something like making an omelet with eggs only half of which are spoiled.—Hugo Muench: Figures, Fancies, and Fancy Figures. *American Journal of Public Health,* February 1959.

# ADAPTABILITY SCREENING OF FLYING PERSONNEL

## Preliminary Analysis and Validation of Criteria of Adaptability to Military Flying

ALBERT L. KUBALA, *Ph. D.*

THIS report is one of a series of research reports on the development of adaptability screening of flying personnel. It is related to that part of this research program which is concerned with the development and evaluation of criteria used for test validation. The over-all experimental design of the research program has been described in earlier reports.[1-3] The data used in this study were taken from material systematically collected since 1949 as an integral part of the research program.

The goal of all selection research is the procurement of men qualified to undertake the assigned tasks. Inherent in this goal is the prediction of ultimate success of the applicants for the task. However, except for the simplest tasks which require largely psychomotor skills or other special abilities, one rarely has available anything which even approaches a measure of ultimate success which can be used as a criterion to develop and evaluate his tests. In most research, the ultimate criterion is a useful concept, but a practical impossibility.

The term "ultimate" implies that the criterion score is an errorless reflection of the final over-all value of the person in his occupation. Even if it were possible to compile measures of ultimate criteria, they would hardly be feasible for use from a practical standpoint, for their maturity would require an extended period of time, and the processing and synthesizing of vast amounts of data. As a result, it is necessary to accept some substitute; some measure which is a good approximation to the ultimate criterion. These substitute measures have been called "intermediate" criteria by Thorndike.[4]

In his discussion of intermediate criteria, Thorndike listed several necessary attributes of criteria. These are: (1) reliability;

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From Department of Medical Psychology, U. S. Air Force, School of Aviation Medicine, Randolph Air Force Base, Texas. Report 58-121. Dr. Kubala is now at Texas Woman's University, Denton, Texas.

(2) freedom from bias; (3) practicality, that is, availability with reasonable expenditure of time and effort; and (4) relevance to the ultimate criterion. It is usually possible to determine or estimate the reliability of such criteria, and by careful selection to make them relatively free from bias. The practicality is usually administratively determined, but the investigator is always left with the question of relevance.

Actually, the question of relevance of the intermediate criteria is a question of the relevance of the characteristics they reflect. If an intermediate criterion is reliable, it definitely measures something, but this does not guarantee that the characteristic or characteristics reflected are relevant to ultimate success on the job. If they are not relevant, predictor tests developed with these criteria cannot be valid predictors of later success. Most investigators are convinced that both personality characteristics and aptitudes or abilities are related to successful job performance, but in the case of the former, they have been able to supply little scientific evidence to support their beliefs. Severin,[5] reporting data tabulated from a vast number of studies in industry and the armed services, found that the median validity of personality tests for the prediction of performance criteria was only 0.15. Data on personality tests tabulated from Guilford and Lacey[6] yielded a median validity of 0.07 for the prediction of graduation-elimination in primary pilot training.* On the other hand, the results with aptitude tests have been more encouraging. Severin reported a median validity of 0.25 with aptitude measures, while validities of 0.50 and above have been consistently reported for pilot stanine, a flying aptitude index, with the graduation-elimination criterion.

These results with predictor tests have led some to question the relevance of personality characteristics as determiners of job-related behavior. Others, not discouraged by the poor results, have proposed several explanations. Most of their arguments concern either the requirements of the task itself, or the relevance of the intermediate criterion measures used in test development. If the task under study does not require a particular trait (for example, the ability to adapt to severe environmental stresses and pressures), then measures of this trait should not be expected to be predictive. Likewise, if the trait is required for successful performance, but the trait is not reflected in the criteria used in test development, then again the test should not be expected to be predictive. The task of the psychologist, therefore, is to discover what characteristics are important determiners of success, and to develop intermediate criteria which reflect these characteristics.

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*This tabulation was made by the writer and is not reported by Guilford and Lacey.

The relevance or validity of the criteria used in personality test development is usually determined on a priori basis, and in synthesizing criteria the separate measures are given weight in accordance with the investigator's intuition about their relevance. The errors which can be made in this practice are obvious, and more scientific methods of determining differential weights are needed.

Guilford[7] suggested that the relevance of predictor tests be determined by looking for common factors in both the predictor tests and the criteria. Jenkins and associates[8,9] suggested an extension of Guilford's approach to include two sets of criteria obtained during two phases of the career sequence. This approach permits the discovery of those factors which are common through time in career success. The investigator can then discard those factors in the earlier criteria which are not relevant to later career stages, thereby "purifying" the earlier criteria. It may be noted that this method of criterion-analysis involves the use of a large amount of criterion information from a later career stage which is assumed to be the best approximation of the ultimate criterion. It is often difficult and expensive to obtain adequate follow-up data on a group of candidates, and for that reason this method has seen little use.

The investigation reported here is concerned with the development of a highly relevant intermediate criterion of *adaptability* to Air Force flying duties. The term "adaptability" refers to those characteristics of persons which are related primarily to motivational and emotional factors, and are associated with the adequacy of continued adjustment to military flying. Adaptability must be distinguished from aptitude or skill factors which also contribute to the total behavioral variance.

More specifically, this investigation is one of a series aimed at evaluating the adaptability criterion measures in current use. These measures, gathered during primary pilot training, have been used in the preliminary development and validation of adaptability screening tests.[1] Their continued use in test development can be justified best by demonstrating that they are related to later success. This demonstration requires criteria from the operational and combat phases of the flying career. These measures should be a closer approximation to an ultimate criterion than the intermediate training-level measures and suitable for testing the relevance, or validity, of the training-level measures.

Although the primary purpose of this research was to evaluate empirically the existing criteria, additional information pertinent to general problems of criterion development and usage was desired. Procedures were sought, therefore, which would answer the following questions:

1. What characteristics of behavior and performance of student pilots are reflected in the training level measures?

2. Which of the characteristics reflected in the early measures are predictive of success in later career stages?

3. Are tests developed with the aid of the early measures able to predict a later criterion successfully?

4. What differences in the relative importance of various personal characteristics are found at different stages in the career sequence?

Questions 3 and 4 are most pertinent to the primary research objective, that of evaluating empirically the usefulness of existing criteria; questions 1 and 2 are designed to provide information of greater value for further research and development of criterion measures.

An outline description of the actual procedures followed and the rationale behind each step in terms of the information desired are given below.

## PROCEDURES

### Internal Analysis of Training-Level Criteria

A total of 41 linearly independent criterion and reference measures of aptitude, performance, and adaptability were available for analysis. These data were factor-analyzed in an attempt to determine what common psychologic factors were being measured, and which specific variables were the best measures of each of these factors. Inferences from this analysis provided information relative to question 1.

### Validation of Training-Level Criteria

Factor scores were computed for each factor represented in the data. These composite scores should be relatively "pure" measures of each factor, and should also be more reliable than any of the individual criterion measures. The factor scores were correlated with a posttraining criterion of effectiveness. The magnitudes and relative sizes of these relationships yielded an estimate of the importance of each of the characteristics represented by the factors in determining posttraining success. Within the limitations imposed by any inadequacies of the posttraining criterion measure, these data were pertinent to question 2.

### Comparison of Adaptability and Aptitude Measures

Comparison of two types of measures for two career stages was used to test a specific hypothesis proposed by Sells[4] which is inherent in question 4. In developing a rationale for the adaptability screening program, Sells criticized the use of a pass-fail in training as a criterion for selection measures based on personality characteristics. His criticism was supported with data from an analysis by Guilford,[7] in which it was shown that

nearly all of the predictable variance in the graduation-elimination criterion was attributable to aptitude or ability factors. Sells further hypothesized that criterion standing in later career stages would be more strongly influenced by personality factors. He reasoned that learning to fly was naturally heavily dependent upon aptitudes as is any learning task, but after training, the ability to handle responsibilities, frustrations, and increased personal hazards would be of greater relative importance. The deduction follows that the training-level adaptability criteria, and therefore the screening devices developed with these criteria, might be only marginally related to training outcome, but should have significant relationships with posttraining criteria. In the present study it was predicted that a measure of *aptitude* for flying would be significantly better than adaptability measures in differentiating success and failure in training, but that the effectiveness of the adaptability measures in predicting the posttraining criterion would be greatly increased relative to the aptitude measure.

Similar reasoning suggested the additional hypothesis that early measures of adaptability would be just as highly related as early measures of flying *proficiency* to a posttraining criterion reflecting subjects' global posttraining adjustment.

To evaluate these hypotheses the magnitude of the relationship between a composite aptitude-performance factor score and the posttraining criterion was compared with that found between a composite adaptability factor score and the posttraining criterion.

The standard Air Force flying aptitude index from the aircrew classification battery and three experimental adaptability screening tests were next compared with respect to both pass-fail status in training and the posttraining criterion.

Although these comparisons were designed primarily to provide data relative to question 4, the comparison of screening tests provided data relative to question 3 since the validities of the adaptability tests for the posttraining criterion can be studied independently of the comparison to determine whether test measures developed with the early criteria are sufficiently sensitive to predict differences in criterion standing on the later criterion measure.

## SAMPLE

The sample in this study consisted of 1,664 men in flight training at Randolph Air Force Base during the period 1949-1951. All of these entered the flying training program as aviation cadets, were between the ages of 20 and 27 at the time of entry, and most had completed at least two years of college. The comparison of the screening tests with pass-fail status was based on data

from all 1,664 cases. The factor analysis and validation study of training-level criteria were made on a subsample of 666 cases consisting of graduates of the program. Smaller samples on whom appropriate data were available were drawn from the group of 666 graduates for the comparisons of the screening tests with the follow-up criterion.

## VARIABLES

### Training-Level Measures

The training-level measures investigated in the present study may be divided into two classes: objective variables and rating variables. In turn, the objective measures may be subdivided into those referring to structured assessments of training performance such as flying or academic grades, those representing aptitude for training, and those which are descriptive of the person.

Similarly, the rating measures may be subdivided into those representing training achievement and those indicative of a person's adaptability. Here a distinction must be made between ratings by peers or superiors and ratings by experts. For example, an evaluation by a tactical instructor of a person's military aptitude would be considered as a rating by an expert, because the instructor is uniquely trained and competent to make such an evaluation. On the other hand, if the same instructor were to evaluate the flying aptitude of a person, this would be considered as a rating by a superior because the instructor is not specifically trained to make such an evaluation.

Using this schema all of the variables may be assigned to one of the categories. The placement of each variable is indicated in table 1. A complete description of the variables is presented on page 822 together with the rationale for the classification indicated in table 1.

Table 1 also includes three global indexes of adaptability, Adjustment Group (AG), Adjustment Rating (AR), and Actuarial Adjustment Rating (AAR). These are described on page 825. Because they were derived, in part, from other training-level measures, they could not be included in the factor analysis.

### Posttraining Criterion

The posttraining criterion data were obtained from the Air Force Form 66, Officers, Warrant Officers and Flight Officer's Qualification Record and supplemental records. This form contains a chronologic record of information that administrative authorities believe is pertinent to the career of the Air Force officer. Abstracts of these records were obtained by research teams from the Department of Medical Psychology, USAF School of Aviation Medicine, who visited the Military Personnel

TABLE 1. *Classification of training level measures*

TABLE 1. *Classification of training level measures*

| | Performance | Aptitude | Descriptive | Adaptability |
|---|---|---|---|---|
| *Objective measures* | Hours flown solo<br>Academic average<br>Flying grade<br>Number of failing flying grades | Pilot stanine<br>Officer quality stanine | Age<br>Previous flying experience | Number of demerits |
| *Ratings by experts* | | | | MAR:* tactical dept.<br>23 ratings by psychologists<br>Adjustment group (AG)<br>Adjustment rating (AR)<br>Actuarial adjustment rating (AAR) |
| *By peers-superiors* | | Flying aptitude rating by psychologist | | Instructor rating: tactical dept.<br>Instructor rating: weather dept.<br>Instructor rating: flying dept.<br>MAR: classmates<br>MAR: upperclass<br>MAR: academic dept.<br>MAR: flying dept. |

*MAR refers to Military Aptitude Rating.

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Records Center, St. Louis, and the Office of the Air Adjutant General, Washington, D. C. Only those data which logically seemed related to posttraining adaptability and proficiency were recorded. From among these, six categories of information were subsequently utilized to develop a criterion score. These were: (1) military schools successfully completed, (2) decorations received, (3) promotions received, (4) number and kind of aircraft qualifications, (5) number and kind of command positions held, and (6) final disposition (that is, whether discharged, killed in action, still in service, et cetera.) Weights were assigned on an a priori basis for accomplishments within each category, and a final criterion score was obtained by summing the weighted scores. Details of the weighting system developed for this criterion have been described by Trites and Kubala[10] and are summarized in table 2.

### Selection Tests

The three adaptability selection tests evaluated in this study were the Cornell index, the Cornell word form, and the personal inventory. The scoring keys used were those developed through research at the School of Aviation Medicine rather than the original keys published by the authors. The research on the Cornell index has been described by Barry and Raynor,[11] research on the Cornell word form has been reported by Barry, Sells, and Trites,[12] and the research on the personal inventory has been published by Trites.[13] Each of these scoring keys has been validated against the training-level criteria in a number of samples since the original findings were reported. The objective aptitude index of pilot stanine was used for comparison with the adaptability screening tests.

## DESCRIPTION OF TRAINING LEVEL CRITERIA

The training level criterion measures are described in outline form below. Classification of these measures follows that given in table 1.

Scores on most of the measures are given in terms of scales. "Goodness" on the measure generally is indicated by a high score. In those cases where this was not true, the scales were reversed prior to analysis. These are indicated by an asterisk preceeding their description.

### Objective Measures

A. Performance

1. Hours flown solo: The total hours of solo time flown during training.
2. Academic average: A normalized nine-point score derived from final numerical academic grades. Good grades received a high score on the scale.

TABLE 2. *Weighting system employed in scoring* the Form 66*

| Weight | Military schools | Decorations | Promotions | Airplane qualifications | Command positions | Dispositions |
|---|---|---|---|---|---|---|
| + 10 | | Congressional Medal of Honor | | | | |
| + 4 | | Distinguished Service Cross<br>Silver Star | | | AF comdr. or air div. comdr. | |
| + 3 | Air War College<br>Air Command & Staff School | Distinguished Flying Cross<br>Distinguished Service Medal | 1st Lt. in 4 months<br>Capt. in 18 months<br>General | Command pilot | Wing comdr.<br>Squadron comdr. | |
| + 2 | Instructor or language school<br>USAFIT (college) | Bronze Star<br>Soldier's Medal<br>Legion of Merit | 1st Lt. in 5-8 months<br>Capt. 19-24<br>Lt. Col.<br>Colonel | 4 or more aircraft*<br>Senior pilot<br>Pilot + 2 aircrew ratings | Flight comdr.<br>Engineer. officer<br>Operations officer<br>Armament officer<br>Communications officer | Resigned, 60 or more months' service |
| + 1 | Administration and personnel<br>Two or more of any schools not listed | Air Medal<br>Commendation Ribbon | 1st Lt. in 9-12 months<br>Capt.<br>Major | 2 or 3 aircraft*<br>Pilot and I aircrew rating | Aircraft comdr. in multiple-engine<br>Material & supply officer<br>Administration & personnel officer<br>Adjutant | Resigned, 48-60 months<br>Killed in action<br>Missing in action |
| 0 | Squadron officers course<br>Technical courses<br>USAFI correspondence course<br>Combat crew training<br>Gunnery transitional training<br>Psychological warfare | Purple Heart | 1st Lt. in 13-19 months | 1 aircraft only | Assistant to + 1 and + 2 Category officers | Resigned, 36-48 months |
| − 1 | | | 1st Lt. in 20-25 months<br>No promotion in 20-24 months and subsequent discharge, resignation, etc. | | | Resigned, 24-36 months<br>Discharge convenience of Government |
| − 2 | | | 1st Lt. in 26-30 months<br>No promotion in 25-30 months and subsequent discharge, resignation, etc. | | | Resigned, 12-24 months<br>Summary court-martial<br>Letter of reprimand |
| − 3 | | | No promotion in 30 or more months | | | Resigned less than 12 months<br>Suspended flying, fear of flying<br>Suspended flying, psychogenic<br>Suspended flying, self-request<br>Discharge other than honorable |
| − 3 to − 5 | | | | | | General court-martial<br>Dishonorable discharge |

*All scoring is cumulative except number of aircraft qualified to fly.

3. Flying grade: A normalized nine-point score derived from final numerical flying grades. Good grades received a high score on the scale.

*4. Number of failing flying grades: The total number of flights failed during training. Poor performance received a higher score.

B. Aptitude

1. Pilot stanine: A score representing an estimate of a subject's flying aptitude derived from a battery of paper-and-pencil and psychomotor tests. Scores are given on a nine-point normalized scale. High aptitude was indicated by a high score on the scale.
2. Officer-quality stanine: A score representing an estimate of a subject's officer-like qualities derived from the same battery of tests as the pilot stanine. Sometimes interpreted as a measure of intelligence. Scores are given on a nine-point normalized scale. High aptitude received a high score.

C. Descriptive

1. Age: A measure which was dichotomized so that a score of 0 was given subjects who were 21 years old or less at the time of entry into primary training. A score of *1* was given to all older subjects.
2. Previous flying experience: A measure which was dichotomized so that a score of *0* was given to subjects who had either no experience or passenger time only prior to entering training. For more experience, a score of *1* was given.

D. Adaptability

*1. Number of demerits: A score on a normalized nine-point scale. The score is based on the total number of demerits accrued during the entire training period. A high number of demerits received a high score on the scale

**Ratings by Experts (Adaptability Only)**

1. Military aptitude ratings (MAR): The military aptitude ratings (MAR) are evaluations of a man's military aptitude. Evaluations are made on a 25-item checklist, each item having 5 points. Ratings are summed over raters for each subject and converted to a normalized nine-point scale. High aptitude ratings received high scores on the scale. Only MAR's from instructors in the tactical department were considered to be ratings by experts, since only the tactical department was trained to give such ratings and was in a position to observe appropriate behavior.
2. Psychologist ratings: These ratings were made on a three-point scale (poor = 0, questionable = 1, and good = 2) from information obtained during an interview supplemented with individually administered clinical tests. Because of the large number of separate ratings, only the names of the traits are listed without description of their meaning.

   General ability
   Flying aptitude

Balance (Is performance commensurate with ability?)
Motivation relative to age and status
Motivation relative to Air Force career
Motivation relative to pilot training program
Strength of drive
Sustaining of drive
Maturity
Stability and balance
Conflicts (internal)
Stress reactions and tolerance
Frustration reactions and tolerance
Hostility feelings and management
Rivalry reactions
Distraction reactions
Educability
Super-ego (guilt, self-esteem, et cetera)
Ego-social centrism
Mental health prospects
Concern with health
Psychosexual
Interpersonal relations
Over-all rating

*3. Adjustment group (AG): An over-all rating by a clinician using all information available on a subject, including the previously listed psychologists' ratings, number of demerits, flying and academic grades, et cetera. Subjects are rated on a five-point scale, ranging from *1* (very well adjusted to training and with a good prognosis for the future) to *5* (very poorly adjusted to training and a poor prognosis for the future).

4. Adjustment rating (AR): This rating is derived from the global evaluations of motivation and personality made in conjunction with the psychologists' ratings described previously. Scores are assigned on a nine-point scale, ranging from *1* (inadequate motivation and personality) to *9* (excellent motivation and personality).

5. Actuarial adjustment rating (AAR): The AAR is based entirely on the psychologists' ratings of specific characteristics listed earlier. To obtain this score, the scores on several of the specific motivation and personality ratings were summed, and these sums were T-scaled. The data for each psychologist were handled separately in order to eliminate rater differences. Good adjustment was indicated by a high score on the scale.

**Ratings by Peers-Superiors**

A. Aptitude

1. Flying aptitude rating (by psychologists): A rating on a three-point scale (poor = 0, questionable = 1, and good = 2) of each subject's flying aptitude by a psychologist. High aptitude was indicated by a high score on the scale.

B. Adaptability

1. Instructor ratings (IR): Instructors of each department were asked to rate each man for adaptability on an over-all basis as either 1-outstanding, 2-satisfactory, 3-questionable or 4-unsatisfactory. Ratings by instructors on adaptability per se were not regarded as ratings by experts because the instructors were not trained in making such ratings. IR's were obtained from three sources:
   a. Tactical department
   b. Weather department
   c. Flying department
2. Military aptitude ratings (MAR): These ratings, described earlier, are evaluations of a man's military aptitude made on a five-point scale on 25 items. Ratings were summed and converted to a normalized nine-point scale. A high rating was indicated by a high score on the scale. Peer-superior ratings differ from expert ratings in that the peer-superior raters are not trained to make such ratings. Ratings were obtained from four sources:
   a. Classmates
   b. Upperclass
   c. Academic department
   d. Flying department

## ANALYSIS OF TRAINING-LEVEL CRITERIA

The internal analysis of the criteria was accomplished in two parts. It would have been possible to factor the intercorrelation matrix of the 41 linearly independent measures indicated in table 1, but examination of the matrix revealed that the intercorrelations of the 24 psychologists' ratings were extremely high on the whole, suggesting a strong "halo effect." Since it was obvious that the content of these ratings could be represented by fewer than the total number of measures these ratings were analyzed separately. Factoring was accomplished by Thurstone's[14] complete centroid method with the highest correlation in each column used for the communality estimate. Six factors were found. The criteria for cessation of factoring suggested by Guilford and Lacey,[6] Mosier,[15] and Burt and Banks[16] were used. Factors were rotated blindly with orthogonal simple structure as the goal. Rotations were accomplished by graphically plotting the factors two at a time.

No details of interpretation will be presented for this analysis inasmuch as the primary purpose was the identification of a small number of variables for further analysis. One variable was chosen to represent each of the six factors in the final analysis. The use of factor scores was contemplated, but the possibility was rejected because it was difficult to find even one measure for each factor which was reasonably "pure" fac-

torially. A brief description of the variables used to estimate the factors is given on page 822. The intercorrelation matrix and the rotated factor loadings are given in tables 3 and 4.

TABLE 3. *Intercorrelation matrix of psychologist ratings* *

| Variables | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Abilities: General | 58 | 54 | 02 | 12 | 04 | 04 | 05 | 33 | 14 | 08 | 24 | 24 | 16 | 26 | 35 | 58 | 10 | 06 | 20 | 30 | 04 | 13 | 54 |
| 2. Abilities: Flying aptitude | | 45 | 04 | 16 | 12 | 12 | 22 | 16 | 07 | 04 | 20 | 24 | 18 | 10 | 28 | 30 | 11 | 12 | 08 | 26 | 13 | 15 | 42 |
| 3. Abilities: Balance | | | 06 | 00 | 06 | 03 | 04 | 28 | 18 | 15 | 30 | 35 | 02 | 81 | 34 | 46 | 24 | 05 | 04 | 42 | 34 | 21 | 43 |
| 4. Motivation re age and status | | | | 61 | 52 | 53 | 46 | 40 | 36 | 38 | 39 | 17 | 26 | 38 | 32 | 38 | 40 | 20 | 20 | 37 | 26 | 20 | 58 |
| 5. Motivation re AF career | | | | | 79 | 45 | 42 | 26 | 36 | 34 | 39 | 39 | 40 | 32 | 32 | 40 | 40 | 46 | 42 | 26 | 36 | 37 | 67 |
| 6. Motivation re pilot training program | | | | | | 43 | 43 | 26 | 36 | 40 | 38 | 42 | 24 | 38 | 36 | 39 | 40 | 32 | 38 | 36 | 37 | 30 | 46 |
| 7. Motivation re strength of drive | | | | | | | 66 | 34 | 54 | 43 | 51 | 42 | 48 | 68 | 22 | 50 | 41 | 53 | 44 | 00 | 43 | 42 | 62 |
| 8. Motivation re sustaining drive | | | | | | | | 28 | 46 | 47 | 42 | 46 | 36 | 27 | 54 | 36 | 32 | 33 | 34 | 38 | 34 | 35 | 59 |
| 9. Maturity | | | | | | | | | 32 | 40 | 31 | 35 | 38 | 39 | 26 | 46 | 32 | 36 | 48 | 24 | 37 | 36 | 55 |
| 10. Stability and balance | | | | | | | | | | 59 | 74 | 68 | 50 | 40 | 38 | 37 | 39 | 32 | 67 | 34 | 44 | 46 | 76 |
| 11. Conflict | | | | | | | | | | | 60 | 60 | 52 | 34 | 50 | 35 | 56 | 46 | 75 | 36 | 64 | 54 | 70 |
| 12. Stress reaction and tolerance | | | | | | | | | | | | 77 | 54 | 46 | 56 | 36 | 40 | 42 | 72 | 42 | 55 | 45 | 74 |
| 13. Frustration reaction and tolerance | | | | | | | | | | | | | 56 | 46 | 52 | 37 | 46 | 42 | 64 | 55 | 46 | 46 | 74 |
| 14. Hostility feelings and management | | | | | | | | | | | | | | 48 | 13 | 44 | 34 | 41 | 58 | 22 | 38 | 52 | 52 |
| 15. Rivalry reaction | | | | | | | | | | | | | | | 32 | 42 | 44 | 32 | 55 | 10 | 41 | 24 | 58 |
| 16. Distraction reaction | | | | | | | | | | | | | | | | 45 | 46 | 27 | 48 | 00 | 50 | 31 | 54 |
| 17. Educability | | | | | | | | | | | | | | | | | 35 | 35 | 46 | 30 | 36 | 47 | 64 |
| 18. Super-ego (guilt, self-esteem, etc.) | | | | | | | | | | | | | | | | | | 40 | 46 | 29 | 42 | 42 | 54 |
| 19. Ego-social centrism | | | | | | | | | | | | | | | | | | | 52 | 35 | 34 | 46 | 52 |
| 20. Mental health prospect | | | | | | | | | | | | | | | | | | | | 35 | 52 | 54 | 75 |
| 21. Concern with health | | | | | | | | | | | | | | | | | | | | | 46 | 50 | 46 |
| 22. Psychosexual | | | | | | | | | | | | | | | | | | | | | | 40 | 58 |
| 23. Interpersonal relation | | | | | | | | | | | | | | | | | | | | | | | 56 |
| 24. Over-all characterization | | | | | | | | | | | | | | | | | | | | | | | |

*Decimal points have been omitted.

TABLE 4. *Factor analysis of psychologist ratings: rotated factor loadings**

| Variables | I | II | III | IV | V | VI | $h^2$ |
|---|---|---|---|---|---|---|---|
| 1. Ability, general | .06 | **.90** | .08 | .02 | -.14 | -.15 | .86 |
| 2. Flying aptitude | .09 | .60 | .14 | .15 | -.07 | .01 | .42 |
| 3. Ability, balance | .08 | .64 | .04 | .30 | .21 | .31 | .65 |
| 4. Motivation relative to age and status | .23 | .02 | .69 | .06 | .02 | .09 | .54 |
| 5. Motivation relative to AF career | .41 | -.07 | **.72** | -.07 | -.06 | -.21 | .74 |
| 6. Motivation for pilot training | .40 | -.14 | .71 | -.10 | -.06 | -.08 | .70 |
| 7. Strength of drive | .54 | .00 | .35 | .47 | .19 | .05 | .67 |
| 8. Sustaining of drive | .48 | .05 | .41 | .10 | .07 | .32 | .52 |
| 9. Personality dynamics - maturity | .30 | .29 | .30 | .14 | .30 | -.08 | .38 |
| 10. Stability and balance | **.77** | .15 | .08 | .01 | .08 | .01 | .63 |
| 11. Conflicts | .71 | -.02 | .20 | -.03 | .35 | .11 | .68 |
| 12. Stress reactions and tolerance | **.88** | .20 | .05 | -.07 | -.03 | .01 | .82 |
| 13. Frustration reactions and tolerance | **.85** | .23 | .03 | -.21 | .07 | -.04 | .83 |
| 14. Hostility feelings and management | .57 | .10 | .09 | .15 | .32 | -.26 | .54 |
| 15. Rivalry reactions | .50 | .14 | .27 | .45 | .06 | -.24 | .61 |
| 16. Distraction reactions | .51 | .24 | .28 | .14 | .05 | **.43** | .60 |
| 17. Educability | .28 | .54 | .39 | .19 | .30 | .03 | .65 |
| 18. Super-ego (guilt, self-esteem, etc.) | .46 | .04 | .35 | .05 | .30 | .07 | .43 |
| 19. Ego-social centrism | .42 | .02 | .27 | .05 | .37 | -.19 | .43 |
| 20. Mental health prospects | **.77** | .12 | .11 | .10 | .24 | -.28 | .77 |
| 21. Concern with health | .35 | .18 | .25 | **-.69** | .28 | -.13 | .79 |
| 22. Psychosexual | .56 | .08 | .23 | -.07 | .31 | .17 | .50 |
| 23. Interpersonal relations | .45 | .13 | .19 | -.10 | **.52** | -.07 | .54 |
| 24. Over-all rating | **.72** | .48 | .45 | .00 | .06 | -.03 | .96 |

*Factor loadings in boldface type indicate that the variable was chosen to define that factor in the subsequent analysis.

TABLE 5. *Intercorrelations of the training-level criteria**

| Variables | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Age | 10 | -03 | 14 | 20 | 05 | -06 | 00 | 39 | 37 | 16 | -09 | 15 | 17 | 25 | 09 | -04 | -10 | 08 | 05 | -15 | 18 | -08 |
| 2. Pilot stanine | | 65 | 40 | 47 | -04 | 27 | 10 | 33 | 22 | 23 | 28 | 15 | 12 | 16 | 30 | 28 | 53 | 16 | 18 | 22 | 16 | 15 |
| 3. Officer quality stanine | | | 21 | 55 | -08 | 14 | -11 | -05 | 25 | 33 | 18 | 11 | 04 | 16 | 35 | 22 | 61 | 04 | 10 | 19 | 15 | 12 |
| 4. Flying grade | | | | 31 | 00 | 16 | 37 | 44 | 19 | 24 | 57 | 24 | 10 | 27 | 10 | 42 | 12 | 07 | 11 | 04 | 04 | 17 |
| 5. Academic average | | | | | 08 | 15 | 09 | 14 | 29 | 57 | 30 | 28 | 16 | 30 | 52 | 30 | 48 | 18 | 18 | 25 | 08 | 15 |
| 6. Demerits | | | | | | 01 | 00 | 06 | 34 | -01 | 08 | 22 | 27 | 31 | 09 | 09 | -04 | 12 | 06 | -06 | 03 | 00 |
| 7. Failing flying grades | | | | | | | 35 | 22 | 12 | 04 | 14 | 18 | 22 | 22 | 08 | 22 | -08 | 20 | 21 | 23 | -05 | 20 |
| 8. Hours flown solo | | | | | | | | 30 | 01 | -05 | 33 | 06 | 00 | 06 | -02 | 11 | 16 | 25 | 00 | -11 | -08 | -03 |
| 9. Previous flying experience | | | | | | | | | 24 | -05 | 16 | 12 | 03 | 13 | 04 | 13 | 06 | 16 | 14 | 11 | 23 | 07 |
| 10. IR tactical dept. | | | | | | | | | | 43 | 31 | 43 | 58 | 74 | 48 | 21 | 13 | 40 | 08 | 00 | 00 | 29 |
| 11. IR weather dept. | | | | | | | | | | | 26 | 24 | 13 | 36 | 48 | 09 | 36 | 15 | 02 | -06 | -18 | 04 |
| 12. IR flying dept. | | | | | | | | | | | | 12 | -06 | 27 | 20 | 49 | 28 | 35 | 01 | 29 | -14 | 07 |
| 13. MAR classmates | | | | | | | | | | | | | 62 | 57 | 22 | 26 | 05 | 12 | 17 | 06 | 08 | 16 |
| 14. MAR upperclass | | | | | | | | | | | | | | 61 | 13 | 15 | -04 | 18 | 21 | 24 | 07 | 18 |
| 15. MAR tactical dept. | | | | | | | | | | | | | | | 30 | 22 | 09 | 16 | 20 | 12 | 16 | 11 |
| 16. MAR academic dept. | | | | | | | | | | | | | | | | 23 | 29 | 08 | 10 | 09 | 13 | 06 |
| 17. MAR flying dept. | | | | | | | | | | | | | | | | | 21 | 08 | 14 | 20 | 21 | 11 |
| 18. Psych. rating—general ability | | | | | | | | | | | | | | | | | | 12 | 24 | 35 | 30 | 13 |
| 19. Psych. rating—motivation re AF career | | | | | | | | | | | | | | | | | | | 39 | 32 | 26 | 37 |
| 20. Psych. rating—stress reactions and tolerance | | | | | | | | | | | | | | | | | | | | 56 | 42 | 45 |
| 21. Psych. rating—distraction reactions | | | | | | | | | | | | | | | | | | | | | 00 | 31 |
| 22. Psych. rating—concern with health | | | | | | | | | | | | | | | | | | | | | | 50 |
| 23. Psych. rating—interpersonal relations | | | | | | | | | | | | | | | | | | | | | | |

*Decimal points have been omitted.

The intercorrelation matrix, consisting of the psychologists' ratings chosen from the previous analysis and the remaining linearly independent measures, is presented in table 5. This matrix was factored by a National Cash Register-102-A electronic computer. The computer program employed Thurstone's[14] complete centroid method of factoring with the highest correlation in each column used for the communality estimate. The criterion for cessation of factoring was one developed specifically for the computer. Factoring was terminated when the average of the obtained communalities for all variables exceeded the average of the original communality estimates. The development of the computer program and this criterion for cessation of factoring has been described in a technical report.[17]

Seven factors were extracted in this analysis. The unrotated factor loadings are presented in table 6. The factors were rotated blindly, two at a time by the graphic method. A relatively clear structure became apparent after only a few plots, and little difficulty was encountered in approximating orthogonal simple structure. The rotated factor loadings are presented in table 7.

TABLE 6. *Analysis of training-level measures: unrotated factor loadings*

| Variable | Unrotated factor loadings* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | $h^2$ |
| 1. Age | 22 | 19 | 20 | -16 | -39 | -18 | -13 | 35 |
| 2. Pilot stanine | 60 | -35 | -21 | -04 | -29 | 23 | 19 | 70 |
| 3. Officer quality stanine | 47 | -44 | -33 | -35 | -08 | 23 | 09 | 71 |
| 4. Flying grade | 53 | -29 | 29 | 39 | -19 | 10 | -20 | 69 |
| 5. Academic average | 65 | -36 | -06 | -24 | 06 | -09 | -14 | 64 |
| 6. Demerits | 19 | 22 | 20 | -11 | 08 | -08 | 08 | 16 |
| 7. Failing flying grades | 35 | 07 | 06 | 27 | 08 | 24 | 17 | 30 |
| 8. Hours flown solo | 21 | -10 | 22 | 42 | -15 | -10 | 25 | 37 |
| 9. Previous flying experience | 38 | 10 | 12 | 28 | -52 | -10 | 11 | 54 |
| 10. IR tactical dept. | 67 | 23 | 38 | -34 | 12 | -30 | 20 | 91 |
| 11. IR weather dept. | 43 | -32 | 14 | -38 | 21 | -21 | -18 | 57 |
| 12. IR flying dept. | 49 | -36 | 19 | 38 | 24 | -09 | 15 | 64 |
| 13. MAR classmates | 51 | 24 | 30 | -19 | 08 | 22 | -12 | 51 |
| 14. MAR upperclass | 46 | 48 | 23 | -29 | 14 | 31 | 07 | 70 |
| 15. MAR tactical dept. | 64 | 28 | 38 | -26 | 08 | 08 | 03 | 71 |
| 16. MAR academic dept. | 49 | -23 | 06 | -27 | 12 | -15 | -15 | 43 |
| 17. MAR flying dept. | 47 | -18 | 09 | 24 | 10 | 16 | -13 | 37 |
| 18. Psych. rating—general ability | 48 | -44 | -44 | -17 | -13 | -09 | 16 | 70 |
| 19. Psych. rating—motivation re AF career | 46 | 23 | -16 | 24 | 15 | -37 | 25 | 57 |
| 20. Psych. rating—stress reactions and tolerance | 45 | 36 | -48 | 17 | 10 | 07 | -14 | 63 |
| 21. Psych. rating—distraction reactions | 37 | 10 | -43 | 18 | 38 | 25 | 21 | 62 |
| 22. Psych. rating—concern with health | 30 | 24 | -41 | 06 | -30 | -13 | -36 | 56 |
| 23. Psych. rating—interpersonal relations | 40 | 31 | -41 | 18 | 12 | -10 | -15 | 50 |

*Decimal points have been omitted.

## Factor Interpretation

The interpretation of the factors is based largely upon the data in table 8. This table lists the factor loadings of the variables defining each factor. The relatively well isolated clusters obtained after rotation left little question as to choice of defining variables and contributed toward an answer to question

1: "What characteristics of behavior and performance are reflected in the training level measures?"

TABLE 7. *Analysis of training-level measures: rotated factor loadings*

| Variables | Rotated factor loadings* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | $h^2$ |
| 1. Age | 28 | -02 | -06 | -04 | -49 | 13 | 10 | 35 |
| 2. Pilot stanine | 15 | 76 | 09 | 29 | -13 | 00 | -07 | 71 |
| 3. Officer quality stanine | 15 | 81 | 05 | 01 | 10 | -10 | 12 | 72 |
| 4. Flying grade | 17 | 14 | 00 | 74 | -22 | -10 | 16 | 68 |
| 5. Academic average | 26 | 52 | 10 | 20 | 02 | 11 | 46 | 61 |
| 6. Demerits | 32 | -11 | 04 | -01 | 00 | 23 | 00 | 17 |
| 7. Failing flying grades | 20 | 07 | 22 | 37 | 10 | 03 | -24 | 30 |
| 8. Hours flown solo | -06 | 00 | -08 | 50 | -12 | 25 | -18 | 37 |
| 9. Previous flying experience | 10 | 13 | 05 | 37 | -56 | 20 | -18 | 55 |
| 10. IR tactical dept. | 68 | 10 | 05 | 08 | -03 | 63 | 19 | 92 |
| 11. IR weather dept. | 31 | 27 | -10 | 04 | 15 | 17 | 56 | 55 |
| 12. IR flying dept. | 02 | 16 | 05 | 68 | 24 | 26 | 14 | 64 |
| 13. MAR classmates | 68 | 01 | 16 | 15 | -02 | 00 | 08 | 52 |
| 14. MAR upperclass | 78 | -02 | 26 | -05 | 06 | 07 | -16 | 71 |
| 15. MAR tactical dept. | 78 | 06 | 12 | 16 | -03 | 25 | 08 | 72 |
| 16. MAR academic dept. | 29 | 30 | 04 | 10 | 10 | 16 | 45 | 42 |
| 17. MAR flying dept. | 19 | 15 | 18 | 49 | 06 | -09 | 14 | 36 |
| 18. Psych. rating—general ability | -10 | 78 | 14 | 05 | 02 | 16 | 16 | 69 |
| 19. Psych. rating—motivation re AF career | 00 | 05 | 45 | 20 | -01 | 57 | 00 | 57 |
| 20. Psych. rating—stress reactions and tolerance | 10 | 12 | 78 | 02 | -08 | 00 | 00 | 64 |
| 21. Psych. rating—distraction reactions | 04 | 26 | 60 | 13 | 38 | 05 | -19 | 63 |
| 22. Psych. rating—concern with health | -04 | 12 | 50 | -08 | -50 | -07 | 17 | 56 |
| 23. Psych. rating—interpersonal relations | 02 | 05 | 69 | 04 | -09 | 10 | 09 | 51 |

*Decimal points have been omitted.

*Factor I.* This factor is defined by three of the military aptitude ratings and the instructor rating from the tactical, or military training, department. Although the instructor rating is an overall rating, it is evident from its loading on this factor that it was strongly influenced by military conduct. There seems to be no question in the interpretation of this factor, henceforth referred to as the *military aptitude factor.*

*Factor II.* Two of the aircrew classification battery scores, officer quality stanine and pilot stanine, appeared among the defining variables on this factor. The psychologists' rating of general ability and academic average rounded out the cluster. Because all of these measures presumably reflect aptitudes and abilities, the factor was called the *ability factor.* The term "ability" rather than "aptitude" was chosen because it was thought that the defining variables reflected a variety of capacities, and that "aptitude" carried too narrow a connotation.*

*It should be noted that the variable having the highest loading (.81) on this factor is officer quality stanine and that this variable has no other factor loadings greater than .15. This indicates that the name "officer quality stanine" may be considered inappropriate with respect to the type of military aptitude defined by factor I. Because of the high correlation between academic average and officer quality stanine (r=.55), this variable might be regarded as an index of aptitude for academic achievement and renamed accordingly.

TABLE 8. *Training-level variables with loadings greater than 0.40 on each of the seven factors*

| Factor | Rotated factor loading |
|---|---|
| *Factor I (military aptitude factor)* | |
| *Military aptitude rating—tactical dept. | .78 |
| *Military aptitude rating—upperclassmen | .78 |
| *Military aptitude rating—classmates | .68 |
| Instructors' rating—tactical dept. | .68 |
| *Factor II (ability factor)* | |
| *Officer quality stanine | .81 |
| *Psychologist rating—general ability | .78 |
| *Pilot stanine | .76 |
| Academic average | .52 |
| *Factor III (personal adjustment)* | |
| *Psychologist rating—stress reactions and tolerance | .78 |
| *Psychologist rating—interpersonal relations | .69 |
| Psychologist rating—distraction reactions | .60 |
| Psychologist rating—concern with health | .50 |
| Psychologist rating—motivation relative to AF career | .45 |
| *Factor IV (flying performance)* | |
| *Flying grade absolute | .74 |
| *Instructors' rating—flying dept. | .68 |
| *Hours flown solo | .50 |
| *Military aptitude rating—flying dept. | .49 |
| *Factor V (age)* | |
| *Previous flying experience | .56 |
| Psychologist rating—concern with health | .50 |
| *Age at time of entry into flying training | .49 |
| *Factor VI (military conformity)* | |
| Instructors' rating—tactical dept. | .63 |
| *Psychologist rating—motivation relative to AF career | .57 |
| *Factor VII (educability)* | |
| *Instructors' rating—weather dept. | .56 |
| Academic average | .46 |
| *Military aptitude rating—academic dept. | .45 |

*Variable used in estimating the factor score.

*Factor III.* All of the psychologists' ratings except the general ability rating loaded heavily on this factor. This result was not expected inasmuch as these ratings were chosen from the previous analysis on the basis of their independence—that is, because each represented the best available measure of a different orthogonal factor. The variance the measures have in common with each other, however, is evidently still greater than the variance they have in common with other measures in the matrix. A "halo effect" resulting from a general impression the psychologist obtained during the interview is probably responsible. The ratings are not, however, necessarily invalid. It is quite possible that these ratings reflect an aspect of

personality not measured by the other data, and this aspect may be an important determinant of success. At least until the validity of the factor was tested, the term *personal adjustment factor* was applied.

*Factor IV*. Factor IV was primarily defined by two objective flying performance measures and two ratings by the flying department instructors. These ratings by the instructors, as those of the tactical department, seem to have been strongly influenced by performance in the specialty of the instructors. Because all of these measures came from the flying department, the title of *flying performance factor* was assigned to this factor.

*Factor V*. This factor was the most difficult to interpret. The only logical relationship in the cluster is between age and previous flying experience. It is to be expected that the older men would have more opportunity to obtain flying experience prior to entry into the service. For lack of a better interpretation, this factor was called the *age factor*.

*Factor VI*. The defining variables of tactical department instructors' rating and the psychologist rating of motivation relative to an Air Force career are logically related inasmuch as it was expected that the desire for a military career would be reflected in ratings by tactical department instructors. An alternative explanation of the factor would be to assume that individuals who tend to conform to the needs of the military and accept the authority relationships inherent in the training situation would be perceived more favorably by the tactical officers and psychologists. If this were so, then the factor might be related to conformity. Hence, the most descriptive name seemed to be *military conformity factor*.

*Factor VII*. The defining variables for factor VII are all related to academic success and, as might be expected, load appreciably on the ability factor. Nevertheless, some source of variance independent of ability also is reflected in these measures. It seems that a motivation peculiar to academics, manifested by interest, attention, and studiousness, could best account for the covariation. On the basis of this reasoning, the factor was called the *educability factor*.

Assuming that the preceding interpretations are correct, there are four factors (military aptitude, personal adjustment, military conformity, and educability) related primarily to adaptability, two factors (ability and flying performance) related to aptitude and technical proficiency, and one factor (age) with no apparent psychologic meaning.

### Validity of Training-Level Criteria

The second phase of the investigation was concerned with the relevance of the training-level factors to posttraining measures. As an estimate of each of the seven training-level factors the defining variables marked with an asterisk in table 8 were converted to standard scores and summed with unit weights as suggested by Trites and Sells.[18]

Table 9 contains the results of the correlational analysis of the factor scores with the follow-up criterion. Included with the seven factor scores are the three global indexes of adaptability: the adjustment rating, the actuarial adjustment rating, and the adjustment group. Because these have seen much use in test development, estimates of their relevance were desired. In this table and all succeeding tables, a positive correlation indicates a relationship which is in the expected direction.* Inasmuch as the direction of each relationship was predicted on a priori grounds, the probabilities reported are for one-tailed tests of significance. The data in this portion of the analysis provide information relative to question 2: "Which of the characteristics reflected in the early measures are predictive of success in later career stages?"

TABLE 9. *Validities of the training-level criteria, based on correlations with Form 66 scores*

| Training-level measures | Correlation with Form 66 scores* | Number of cases |
|---|---|---|
| Military aptitude factor | .06 | 358 |
| Ability factor | .14*** | 308 |
| Personal adjustment factor | .09** | 376 |
| Flying performance factor | .16** | 193 |
| Age factor | .02 | 365 |
| Military conformity factor | .08 | 379 |
| Educability factor | .12** | 273 |
| Adjustment group rating | .14*** | 423 |
| Actuarial adjustment rating | .11** | 380 |
| Adjustment rating | .13*** | 381 |

*All probabilities reported for one-tailed tests of significance.
**Significant at the .05 level.
***Significant at the .01 level.

It is obvious from the table that all of the relationships were in the expected direction, and that the ability factor, the personal adjustment factor, the flying performance factor, the educability factor, and all three of the global psychologists' ratings were

*Inasmuch as there was no reason to expect age to be related to effectiveness, the age factor was arbitrarily scaled so that older men got higher scores.

related at low but statistically significant levels ($P < .05$) to the posttraining criterion.

The extremely small relationship between the age factor and the follow-up measure partly supports the interpretation of the factor, as little relationship between age and effectiveness would be expected. The insignificant relationships found with the military aptitude factor and the military conformity factor were surprising. It would seem that motivation for a military career and military conduct should be more predictive of success in a military organization. The lack of relationship found for the military conformity factor can possibly be explained in terms of the unreliability of the factor score, as only one measure was deemed of sufficient factorial purity to be used in factor score estimation. This was not true of the military aptitude factor, which was estimated by three measures, each of which is a composite of scores from a number of raters. It seems likely in retrospect that the military aptitude ratings reflect an adjustment or adaptation to military living. Because the ratings were made relatively late in the training program, most of the men who could not adapt successfully had been eliminated before the ratings were obtained.* Consequently, the group being rated was either initially, or became, very homogeneous with respect to adaptation to military training conditions. This being the case, several explanations may be offered for the lack of relationship with the posttraining criterion.

First, the raters may have judged the men on the basis of their entire performance during the training period. Such judgments would not take into account the increasing homogeneity of the group, thus, the ratings would reflect original differences and not the final homogeneous clustering of the subjects.

Second, it may be that the raters assessed the subjects on the basis of their adaptation to training at the time of rating. If the group were homogeneous, the small differences reflected in the ratings would be expected to have little relationship to the posttraining criterion. This also implies that the reliability of the military aptitude ratings would be low. The intercorrelations of the ratings given in table 5 may be used as rough estimates of their reliability. It can be seen that all of these are below the generally accepted level of variable reliability for simultaneous rating data. This lends some support to this explanation of the negligible relationship with the posttraining criterion.

*Only 51 of the 998 subjects who eventually failed the training program for the time period involved in this research were still in training at the time the military aptitude ratings were obtained.

Finally, it may be that the behaviors assessed in the military aptitude ratings simply have no relationship to posttraining performance and adjustment.

The adjustment rating, the actuarial adjustment rating, and all of the measures which entered into the computation of the factor score for the personal adjustment factor are based on *post hoc* evaluations of the candidates' adjustment to the flying training program, made by members of the research staff after the candidates left the program. The evaluations were based largely on the results of a number of psychologic tests and information obtained during extensive personal interviews with the students. Since all of these measures are significantly related to the posttraining criterion, it appears that the psychologists were capable of differentiating degrees of adjustment even in a highly select and homogeneous group of normal youths. The adjustment group score, a composite rating made by staff members, based on all the information available on a given subject (see page 825) would naturally be expected to be related to the posttraining criterion inasmuch as the majority of the variables from which it was derived were significantly related.

While the magnitudes of the relationships found between the training-level and posttraining measures demonstrate that they are far from being equivalent, there is evidence that the earlier measures approximate the later criterion. Though these results do not justify the exclusive utilization of the training-level measures, they do provide additional evidence that continuity exists between the training and posttraining situations.[19]

### Comparison of Adaptability and Aptitude Measures

To answer question 4 ("What differences in the relative importance of various personal characteristics are found at different stages in the career sequence?") table 10 summarizes the results of one of the comparisons of aptitude and adaptability measures. These two variables, called the total adaptability factor score and the total aptitude factor score, are compounded from the factor scores. The total adaptability factor score is a summation of standard scores from the military aptitude factor, personal adjustment factor, military conformity factor, and educability factor. The total aptitude factor score is a summation of standard scores from the ability factor and the flying performance factor. This simple addition of standard scores does not give the optimum combination for prediction of the posttraining criterion, but multiple regression, although giving maximum prediction, tends to capitalize on chance deviations. Hence, this method should give a more conservative estimate of the comparative validities of the two types of measures.

For those aspects of eventual success in a flying career as measured by the Form 66 score, the aptitude-performance measure is a slightly better predictor than the adaptability measure. The difference between the two correlations, however, is not statistically significant. These results support the hypothesis concerning the equivalence of training-level measures of flying proficiency and adaptability for prediction of a posttraining criterion.

TABLE 10. *Validities of combined factor scores based on correlations with Form 66 scores*

| Score | Correlation with Form 66 score* | Number of cases |
|---|---|---|
| Total aptitude factor score | .19** | 147 |
| Total adaptability factor score | .15** | 262 |

*All probabilities reported for one-tailed tests.
**Significant at the .05 level.

The results of the comparison of adaptability and aptitude screening tests are presented in table 11. The correlation of pilot stanine with pass-fail status in training is significantly greater than the correlations between any of the adaptability tests and pass-fail status, although two of the adaptability measures are significantly related to the pass-fail criterion.

TABLE 11. *Correlations of adaptability measures with an aptitude*

| Variable | Correlation with pass-fail in training | Number of cases | Correlation with Form 66 score | Number of cases |
|---|---|---|---|---|
| Pilot stanine | .53** | 1341 | .13* | 396 |
| Personal inventory | .11* | 679 | .10* | 267 |
| Cornell index | .10* | 1033 | .11* | 335 |
| Cornell word form | .00 | 639 | .05 | 307 |

*Significant at the .05 level.
**Significant at the .01 level.

On the other hand, in comparison with the posttraining criterion, the relationship of the aptitude measure is greatly diminished, while no comparable decrement is found for the relationships with the adaptability measures. The same tests which proved to be significant predictors of pass-fail status also prove to be significant predictors of the posttraining standard, but the obvious superiority of the aptitude measure is no longer evident. Thus, the hypothesis concerning the increase in importance

of adaptability measures relative to ability measures in the prediction of a posttraining criterion is supported.

Other important information is also gained from this comparison. The adaptability screening devices, which were developed with the aid of the training-level criteria, proved to be significant predictors of posttraining effectiveness as reflected by data on the Form 66. Question 3 ("Are tests developed with the aid of the early measures able to predict a later criterion successfully?") therefore can be answered in the affirmative. This finding supports the continued use of the training-level measures in test development work, although the low level of the relationships between the adaptability tests and the posttraining criterion certainly indicates that further study and refinements of the training-level data are needed.

Even though the reported validities of the adaptability selection tests are relatively low using correlation methods, this does not preclude their use in a valid screening battery. The three tests studied were originally validated using cutting scores developed with samples chosen on the basis of the training-level criteria. In operational use these tests may be employed individually, using the predetermined cutting scores, rather than combined by multiple regression technics to form a single cutting score. It is necessary, therefore, to determine whether the tests could be used to advantage operationally, regardless of the magnitude of the correlations with the posttraining criterion.

To estimate the operational utility of the adaptability screening tests, comparisons have been made using the Form 66 score as the criterion. The subjects have been divided into criterion groups—as nearly as possible, into the lower 25 per cent, the middle 50 per cent, and the upper 25 per cent based on the entire distribution of scores on the Form 66 measure. In addition to studying each test singly in relation to the Form 66 score, it was deemed desirable to study the effect of aptitude on the efficiency of screening. To facilitate this study, comparisons were made between the test scores and criterion standing after eliminating subjects with pilot stanine scores of 3 and below, 4 and below, and 5 and below, successively. These pilot stanine values were selected to correspond to recent requirements for entry into pilot training.

Data for these comparisons are presented in tables 12 and 13. The chi-square values reported at the sides of each distribution are the values that are obtained if the cut is made at the point indicated; that is, if all subjects above the cut (low score) are predicted as being well adjusted and all those below the cut (high score) are predicted as being poorly adjusted. No table giving similar data on the Cornell word form is included as the results were not significant.

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The chi-square values obtained indicate that screening on the basis of an aptitude measure has little, if any effect, on the validity of these adaptability screening devices.

TABLE 12. *Validity of the Cornell index at increasing levels of flying aptitude*

| Pilot stanine | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ≥4 | | | | | ≥5 | | | | | ≥6 | | | | |
| | Form 66 | | | | | Form 66 | | | | | Form 66 | | | |
| CI | Lo | M | Hi | $\chi^2$ | CI | Lo | M | Hi | $\chi^2$ | CI | Lo | M | Hi | $\chi^2$ |
| 0 | 18 | 37 | 25 | | 0 | 18 | 32 | 24 | | 0 | 16 | 26 | 17 | |
| 1 | 9 | 35 | 19 | | 1 | 7 | 29 | 18 | | 1 | 5 | 20 | 14 | |
| 2 | 6 | 17 | 10 | | 2 | 6 | 15 | 10 | | 2 | 6 | 13 | 10 | |
| 3 | 4 | 13 | 6 | | 3 | 3 | 13 | 6 | | 3 | 2 | 10 | 6 | |
| 4 | 10 | 9 | 6 | | 4 | 7 | 9 | 4 | | 4 | 3 | 7 | 3 | |
| 5 | 2 | 7 | 4 | 6.34* | 5 | 2 | 6 | 4 | 7.60* | 5 | 2 | 5 | 4 | 6.11* |
| 6 | 4 | 4 | | 2.41 | 6 | 3 | 2 | | 3.96 | 6 | 1 | 2 | | 5.02 |
| 7 | 1 | 4 | 1 | 2.88 | 7 | 1 | 4 | 1 | 4.71 | 7 | 1 | 2 | 1 | 5.88 |
| 8 | 3 | 1 | 1 | 1.30 | 8 | 3 | 1 | 1 | 2.72 | 8 | 3 | 1 | | 1.72 |
| 9 | 1 | | 1 | | 9 | 1 | | 1 | | 9 | 1 | | 1 | |
| 10 | 1 | 3 | 1 | | 10 | 1 | 3 | | | 10 | 1 | 2 | | |
| 11 | 1 | 1 | | | 11 | 1 | 1 | | | 11 | | 1 | | |
| 12 | 1 | | | | 12 | 1 | 1 | | | 12 | 1 | | | |
| 13 | | 1 | | | 13 | | | | | 13 | | | | |
| 14 | | | | | 14 | | | | | 14 | | | | |
| 15 | | 1 | | | 15 | | | | | 15 | | | | |
| 19 | | 1 | | | 19 | | 1 | | | 19 | | 1 | | |
| 26 | | 1 | | | 26 | | 1 | | | 26 | | 1 | | |
| Total | 61 | 135 | 74 | 270 | | 54 | 118 | 69 | 241 | | 42 | 91 | 56 | 189 |

*Significant at less than the .05 level.

Examination of the data for the Cornell index indicates that the cutting score (9 and above) recommended on the basis of previous research is not the most efficient, using the Form 66 measure as the criterion. This may be due in part to restriction in range, as the percentage of cases above the cut in this select sample is very small. These data do indicate, however, that any cutting score from 6 through 9 might be satisfactory.

A significant relationship between the personal inventory and Form 66 criterion standing could not be demonstrated by chi-square in spite of the fact that the product-moment correlation was significant. This may be due to restriction in the range of scores. Examination of the data reveals that no other cutting score could be feasible with this test because too large a proportion would have to be screened.

TABLE 13. *Validity of the personal inventory at increasing levels of flying aptitude*

| Pilot stanine | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ≥4 | | | | | ≥5 | | | | | ≥6 | | | | | | | | | |
| | Form 66 | | | | | Form 66 | | | | | Form 66 | | | | | | | | | |
| PI | Lo 25% | M 50% | Hi 25% | | | PI | Lo 25% | M 50% | Hi 25% | | | PI | Lo 25% | M 50% | Hi 25% | | | | | |
| 0 | 1 | 9 | 0 | | | 0 | | | | | | 0 | | | | | | | | |
| 1 | 28 | 56 | 39 | | | 1 | 27 | 8 | 8 | | | 1 | 19 | 7 | 6 | | | | | |
| 2 | 9 | 34 | 11 | $\chi^2$=.92 | | 2 | 9 | 51 | 36 | | | 2 | 8 | 36 | 29 | | | | | |
| 3 | 4 | 4 | 3 | | | 3 | 4 | 30 | 11 | $\chi^2$=1.57 | | 3 | 4 | 24 | 9 | $\chi^2$=.95 | | | | |
| 4 | 1 | 4 | | | | 4 | 1 | 3 | 3 | | | 4 | | 2 | 3 | | | | | |
| 5 | | | | | | 5 | | 4 | | | | 4 | | 4 | | | | | | |
| 6 | | | 1 | | | 6 | | | | | | 5 | | | | | | | | |
| 7 | | | | | | 7 | | | | | | 6 | | | | | | | | |
| 8 | | | | | | 8 | | | | | | 7 | | | | | | | | |
| 9 | | 1 | | | | 9 | | 1 | | | | 8 | | | | | | | | |
| Total | 43 | 108 | 63 | 214 | | | 41 | 97 | 58 | 196 | | 9 | 31 | 1 | 47 | 152 | | | | |

## DISCUSSION

The results of this study are of considerable value to the adaptability screening program, especially with regard to criterion development, although higher relationships with the posttraining criterion would be desirable. On the other hand, the results are believed to under-estimate the magnitude of the relationships involved, for a number of considerations are known to attenuate the correlations found in this investigation.

First, the sample studied is a much more select group than would be dealt with in an actual screening situation. The relationships obtained with the posttraining criterion were based on a maximum of 666 men who passed the training program, which is only about 40 per cent of the total entering these classes. In addition to this selection during flying training, selection during preflight training occurred, and preselection on the basis of physical qualifications, written examinations, and an interview with a psychiatrist also contributed to the total of eliminated applicants. These selection procedures undoubtedly restricted the range of adaptability characteristics in the sample studied to a considerable degree. Thus, the relationships found are underestimates of the true magnitude of the relationships in the population of applicants for flight training.

Another attenuating factor is the grossness of the Form 66 criterion measure. Although the total score has a relatively wide range and a nearly normal distribution, the scoring within each of the categories is quite crude, and only a small percentage of the group is differentiated as being superior or inferior within each scoring category. Such a gross measure cannot be expected to be too predictable. Further research on the Form 66 material, which is now in progress, may lead to refinements in scoring which permit greater differentiation, and a consequent increase in predictability.

The nature of the material employed in the Form 66 score is also probably responsible for a certain amount of attenuation. Even if the scoring were extremely sensitive, the total score would not present a complete picture of the man's adequacy as a pilot and Air Force officer. The score either does not reflect, or reflects only very indirectly, such things as the amount and type of flying each man does, his relationships with peers and subordinates, how anxious he becomes before and during combat missions or other hazardous flights, his social reputation, and a host of other things which should be taken into account in a truly comprehensive evaluation of a man. It is largely administrative aspects of total performance that are reflected by the Form 66 score, and undoubtedly a criterion which was more heavily weighted with adaptability factors would have produced higher relationships.

Other posttraining criteria, such as a comprehensive evaluation of flying experience using information obtained from AF Form 5, and officer effectiveness reports, are being developed. Further evaluation and refinement of the training-level criteria will be dependent upon findings with these additional posttraining measures as well as the Form 66 score.

## SUMMARY

The present research was directed primarily at an evaluation of the criteria of adaptability employed in preliminary test development and validation work by this school. An attempt was made in this study to answer four questions relevant to criterion development and usage.

*1. What personal characteristics are reflected in the early criterion measures?*

On the basis of a factor analysis it appeared that seven dimensions accounted for most of the variance in the available criteria. These were: military aptitude, ability, personal adjustment, flying performance, age, military conformity, and educability.

*2. Which of the characteristics reflected in the early criteria are predictive of success in later career stages?*

The findings indicated that all components reflected in the early criteria except age and military aptitude were related to eventual success in an Air Force career, although the military conformity factor was related to the Form 66 score at only the .10 level of significance.

*3. Are tests developed with the aid of the early criteria able to predict a later criterion successfully?*

Although only three adaptability tests were studied, two of these were significantly related to the posttraining measure of success. The relationships were of low magnitude, but it was concluded that the continued use of the training-level criteria in preliminary test development was justified, although further study and refinement of these preliminary criteria were indicated.

*4. What differences in the relative importance of various personal characteristics are found at different stages in the career sequence?*

The comparison of adaptability and aptitude measures provided evidence that aptitudes were of much greater importance in determining outcome in pilot training, but that posttraining success was about equally dependent upon aptitudes and adaptability characteristics. Perhaps most important, some practical utility of the training-level adaptability criteria was demon-

strated by the significant relationships found between the experimental adaptability screening tests and the posttraining criterion.

ACKNOWLEDGMENT: A project of this magnitude required the assistance of many people. Specifically, the writer wishes to acknowledge the advice, encouragement, and assistance throughout the course of the study of Drs. Saul B. Sells and David K. Trites, Department of Medical Psychology, School of Aviation Medicine, USAF, and of Dr. Wayne H. Holtzman of the University of Texas. Bart B. Cobb, Department of Medical Psychology, contributed greatly to the statistical analysis of the data; and the critical review of the final manuscript by Dr. Bryce O. Hartman, Department of Medical Psychology, is gratefully acknowledged. The preliminary work on the scoring system used in table 2 was accomplished by Dr. William F. Brown.

REFERENCES

1. Sells, S. B.: *Research Program on the Psychiatric Selection of Flying Personnel: Methodological Introduction and Experimental Design.* School of Aviation Medicine, USAF, Project No. 21-37-002, Report No. 1, Nov. 1951.

2. Sells, S. B., and Barry, J. R.: Research program to develop psychiatric selection of flying personnel; theoretical approach and research design. *J. Aviat. Med.* 24: 29-35, Feb. 1953.

3. Sells, S. B., and Barry, J. R.: Research program to develop psychiatric selection of flying personnel; research progress. *J. Aviat. Med.* 24: 36-47, Feb. 1953.

4. Thorndike, R. L.: *Personnel Selection; Test and Measurement Techniques.* John Wiley & Sons, New York, N. Y., 1949.

5. Severin, D. G.: Predictability of various kinds of criteria. *Personnel Psychol.* 5: 93-104, 1952.

6. Guilford, J. P., and Lacey, J. L. (editors): *Printed Classification Tests.* Aviation Psychology Program, Research Report No. 5. Army Air Forces, U. S. War Department. U. S. Government Printing Office, Washington, D. C., 1947.

7. Guilford, J. P.: Some lessons from aviation psychology. *Am. Psychol.* 3: 3-11, Jan. 1948.

8. Jenkins, J. G., et al.: *The Combat Criterion in Naval Aviation.* N. R. C. Committee on Aviation Psychology, Report No. 6. U. S. Government Printing Office, Washington, D. C., 1950.

9. Jenkins, J. G.: Validity for what? *J. Consult. Psychol.* 10: 93-98, Mar.-Apr. 1946.

10. Trites, D. K., and Kubala, A. L.: Characteristics of successful pilots. *J. Aviat. Med.* 28: 34-40, Feb. 1957.

11. Barry, J. R., and Raynor, G. H.: *Psychiatric Screening of Flying Personnel: Research on the Cornell Index.* School of Aviation Medicine, USAF; Project No. 21-0202-0007, Report No. 2, May 1953.

12. Barry, J. R.; Sells, S. B.; and Trites, D. K.: *Psychiatric Screening of Flying Personnel: Research on the Cornell Word Form.* School of Aviation Medicine, USAF, Project No. 21-0202-0007, Report No. 7, May 1954.

13. Trites, D. K.: *Psychiatric Screening of Flying Personnel: Research on the Personal Inventory Test.* School of Aviation Medicine, USAF, Project No. 21-0202-0007, Report No. 8, Nov. 1954.

14. Thurstone, L. L.: *Multiple Factor Analysis.* University of Chicago Press, Chicago, Ill., 1947.

15. Mosier, C. I.: Influence of change error on simple structure; empirical investigation of effect of chance error and estimated communalities on simple structure in factorial analysis. *Psychometrika* 4: 33-44, Mar. 1939.

16. Burt, C., and Banks, C.: A factor analysis of body measurements for British adult males. *Ann. Eugenics* 13: 238-256, June 1947.

17. Price, B. P., and Grant, R. B.: *Applicability of High Speed Computation to Factor Analysis, Personnel Assignment, and Multiple Discriminant Function.* Research contract report, Southwest Research Institute, San Antonio, Tex., 1954.

18. Trites, D. K., and Sells, S. B.: Note on alternative methods of estimating factor scores. *J. Appl. Psychol.* 39: 455-456, Dec. 1955.

19. Trites, D. K., and Sells, S. B.: Combat performance: measurement and prediction. *J. Appl. Psychol.* 41: 121-130, Apr. 1957.

# LOCAL INJECTION OF VITAMIN A (KERAMIN) FOR PLANTAR VERRUCA

RICHARD S. GILBERT, *Lieutenant, MSC, USN*
MALVIN J. WILLIAMS, *Lieutenant, MC, USNR*

THE purpose of this article is to report the successful use of an aqueous vitamin A preparation, commercially available as Keramin injection, in the treatment of plantar verruca. This represents the results of a study carried out on 100 patients at this training center over a period of 18 months.

Vitamin A given systemically has been claimed to be clinically effective in the treatment of various dermatological disorders associated with hyperkeratosis. These include warts, corns, calluses, exzemas, and excessively dry skin. Oral administration of 100,000 units of vitamin A daily was followed by the disappearance of warts in an encouraging percentage of cases by Fisher and Chamberlain,[1] who used this treatment in a series of 42 cases. Chamberlain[2] also reported that in 60 to 80 per cent of all cases, warts disappeared after 6 to 12 weeks on this regimen. While treating a large number of patients with follicular hyperkeratoses and other dermatological disorders, Straumfjord[3] observed that corns and calluses in many patients receiving a daily intake of 100,000 units of vitamin A for a long period seemed to clear spontaneously. May[4] is of the opinion that vitamin A ". . .should be given first choice amongst the conservative types of therapy for plantar warts." We have used oral vitamin A in treating numerous patients in the past few years with a very minor degree of success. The cases that responded were few, and even then it was difficult to determine whether improvement was due to the vitamin A or to the unpredictable nature of the wart itself.

Vitamin A is stored in the liver and does not normally occur in appreciable quantities in the skin. Only an enormous oral dosage could then be expected to cause enough spill over from the liver to affect skin lesions. It was reasoned that direct injection of the vitamin into a lesion would overcome this difficulty. With this in mind, Steinberg[5,6] investigated the use of vitamin A by local injection into warts and reported encouraging results. A number of undesirable reactions occurred in this

From U. S. Naval Training Center, San Diego, Calif.

early work, however, in the form of local itching, swelling, and hyperemia, which were attributed to the oily dispersion medium. Steinberg also described the use of an aqueous vitamin A preparation for injection which apparently eliminated these local undesirable side effects. This preparation, Keramin injection, has a vitamin A activity of 50,000 units per ml. Various control tests satisfied Steinberg that the vitamin A was the only therapeutically active ingredient in the solution. The composition of this preparation is:

| | | |
|---|---|---|
| Vitamin A palmitate, synthetic | | 50,000 U. S. P. units per ml. |
| dl-$\alpha$-Tocopherol, N. F. | (antioxidant) | 0.4% |
| Butyl hydroxyanisole. | (antioxidant) | 0.03% |
| Polysorbate 80, U. S. P. | (solubilizing agent) | 11.0% |
| Chlorobutanol, U. S. P. | | 0.5% |
| Citrate-phosphate buffer | | 0.25% |
| Water for injection, U. S. P. | | q. s. 100% |

## METHOD

The technic is relatively simple. The area to be treated is prepared with tincture of merthiolate and then anesthetized with 1 per cent Xylocaine hydrochloride (brand of lidocaine hydrochloride) containing 1:100,000 epinephrine. Anesthesia is usually

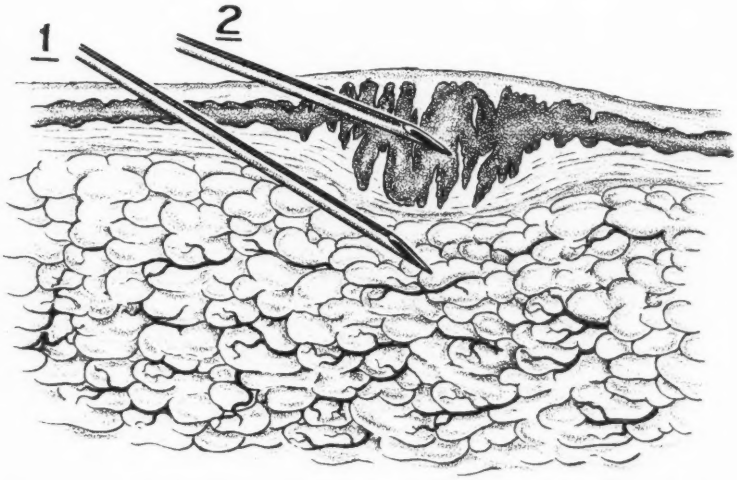


*Figure 1. Enlarged cross section diagram through a verruca in the skin showing position of needles for (1) anesthesia, and (2) injection of vitamin A.*

effective with only 1 ml. A tuberculin syringe with a 26-gage ½-inch needle is used for both anesthesia and Keramin injection. For injection of anesthetic, the needle should be introduced at a point just outside the visable periphery of the lesion,

and the solution deposited beneath the lesion. Keramin is injected deep into the verruca (fig. 1). Both injections are given slowly, with care being taken to avoid entry into a vein. Although injections into the foot, particularly the plantar aspect, have generally been avoided such injections need not be painful. Using a tuberculin syringe to minimize finger pressure, and with a ½-inch, 26-gage needle, production of anesthesia can and should be quick and relatively painless and the subsequent injection of Keramin will then be well tolerated. The number of injections usually depends on the size and type of verruca, although occasionally a small, single type of plantar verruca may prove extremely resistant and require repeated injections. The initial dosage should not exceed 0.1 ml per square centimeter of verrucose area. Further injections are given at weekly intervals with the dosage increased weekly up to 0.3 ml. In cases of mosaic verrucae, or in exceptionally large single planter verrucae, the lesion may be injected from several angles, at which time more than 0.3 ml is needed. All patients are continuously ambulatory with only an adhesive strip for dressing. No supportive therapy, such as arch supports or felt padding was used in these cases.

## RESULTS

The results are summarized in table 1.

The most dramatic aspect of Keramin therapy was the relief of pain. In 95 per cent of the patients, freedom from pain was experienced after the first or second injection, even though the verruca was sometimes still present.

TABLE 1. *Results of Keramin therapy in 100 patients with plantar verrucae*

| Type of plantar verruca | Number of patients treated | Complete resolution | Over-all result unsatisfactory |
|---|---|---|---|
| Single | 55 | 45 | 10 |
| Multiple | 30 | 25 | 5 |
| Mosaic | 15 | 12 | 3 |
| Total | 100 | 82 | 18 |

Involution of the lesion began within a few days after the first injection and the lesion regressed completely in several weeks. The papillary lines reformed and no evidence of skin alteration was present. The patients in this report have all been followed for at least six months following the regression of the initial lesion. Fourteen patients are now in their fifteenth month without recurrence.

The average number of injections was 4.2. As many as 14 injections were required in one patient with an extremely resistant mosaic verruca, while five patients required only a single injection. No explanation can be offered for the occasional failure seen in this study. Keramin injections were discontinued if no involution was noted after three or four injections. Perhaps with a little more persistence, some of the failures may have responded favorably. In a few instances it was noted that verruca present elsewhere on the body regressed following the local injection of Keramin for plantar verruca.

Reactions encountered were few and restricted only to itching around the site of injection. Two patients experienced itching of a mild nature for about 12 hours following the injection. A few additional patients complained of mild itching which subsided within two to three hours. No infection or severe pain occurred in any case. Keramin injection is contraindicated only where injection therapy in general is contraindicated as, for instance, in peripheral neuropathies, diabetes, peripheral vascular diseases, radiodermatitis, or general debility.

## DISCUSSION

Although plantar warts are among the common lesions occurring on the sole of the foot, they are often passed over lightly and frequently mismanaged. The diagnosis need not be difficult if it is remembered that paring down of the lesion will readily reveal the signs by which plantar verruca may be distinguished from callus or corn. The most resistant form of verruca is the mosaic type. This consists in hyperkeratotic, irregularly outlined patches, sometimes as large as a silver dollar, topped with a rather granular, friable, thick, horny layer. It resembles (and is often treated as) a common callus. When this lesion is pared down, the multiple cores are revealed and the patch is seen to be formed from the fusion of several contiguous warts so as to give a mosaic appearance. Mosaic warts resist x-ray therapy and their extensive surfaces usually preclude surgical, electrosurgical, cryotherapy, and many forms of chemotherapy. They are the least common type seen and are often painless, the patient seeking medical attention for cosmetic reasons. The mosaic warts were usually injected from two or three different angles and as much as 0.4 to 0.5 ml of Keramin was needed in some cases. Keramin injection has proved extremely useful in treating this very resistant form of verruca. The multiple or the mother-daughter type of verruca plantaris follows the mosaic type in its resistance to treatment. Here the mother lesion was injected and occasionally one or two of the larger satellites. The results also were very gratifying with this type. In the case of the single or isolated plantar verruca, other technics such as curettage also are effective in many cases and may be used alternatively as the skill and preferences of the operator dictate.

When dealing with service personnel, ambulation is of the utmost importance. Keramin injection permits the patient to return immediately to the job with no bulky bandages or change in bathing habits. This in itself is an advantage over many previous methods of treatment.

## SUMMARY

The local injection of Keramin (vitamin A) into plantar warts resulted in complete resolution in 82 per cent and relief of pain in 95 per cent of a series of 100 cases. No recurrence was observed within a six-month period of observation. Keramin injection appeared to be equally effective in all three types of plantar verrucae. It is especially valuable in the multiple and mosaic varieties where other methods are inadequate as evidenced by the high incidence of failures and recurrences. Extensive surgery with skin grafting, radiation, and the stronger caustics may now be avoided, even in these intractable lesions. The only side reaction was itching, which occurred in a small percentage of patients.

## REFERENCES

1. Fisher, S. H., and Chamberlain, W. E.: Roentgen and vitamin A therapy for treatment of warts; comparison of 2 methods and report of 315 treated cases. *Pennsylvania M. J.* 51: 151-155, Nov. 1947.

2. Chamberlain, W. E.: Warts. (Queries and Minor Notes Section) *J. A. M. A.* 140: 1192, Aug. 6, 1949.

3. Straumfjord, J. V.: Lesions of vitamin A deficiency; their local character and chronicity. *Northwest Med.* 41: 229-233, July 1942.

4. May, H.: Surgical treatment of intractable plantar warts. *S. Clin. North America* 31: 607-616, Apr. 1951.

5. Steinberg, M. D.: New treatment for resistant warts; report of 300 cases. *Surgery* 39: 642-644, Apr. 1956.

6. Steinberg, M. D.: New method for the treatment of resistant verrucae. *J. Nat. Assoc. Chiropodists* 44: 17-25, July 1954.

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## THE PRONOUNCEMENT OF DEATH

One should not hurry in pronouncing death if relatives are present. To offer a specific example: sometime ago a physician was called to care for the son of a fellow practitioner. The child was obviously dead but the attending doctor realized that the father had not consciously accepted the fact. Thus, for a short period, the doctor busied himself with the child while at the same time, with appropriate remarks, prepared the parent for the pronouncment of death. Some may criticize this approach. Others will recognize it as one of the highest forms of the practice of the art of medicine—an art which takes into consideration the emotional response of those to whom the physician ministers.—Edward R. Bloomquist: If a Man Must Die. *The New Physician,* February 1959.

# PARENT ATTITUDES AND CHILD GUIDANCE PRACTICES

JAMES H. BRYAN, *First Lieutenant, MSC, USAR*
PERRY LONDON, *First Lieutenant, MSC, USA*
CARL LAUTERBACH, *Captain, MSC, USA*

THE crucial role of parents in the formation, continuation, and resolution of children's emotional disorders is all but universally recognized by workers in child guidance. This knowledge has dictated some common administrative policies regarding treatment in many clinics. Some agencies refuse psychotherapeutic treatment to children whose parents will not simultaneously undergo therapy; others, though not insistent that the parent receive therapy, demand intermittent interviews with parents either for counseling purposes or for collating information about the child and family.[1-4]

Generally, the mother is specified by the clinic as the "significant other" to be worked with, while the father is typically relegated to a minor role. While this position is, in part, an inevitable consequence of the practically greater accessibility of mothers in terms of free hours, it also is dictated by presumably sound theoretical notions.

On rational grounds, it may be argued that mothers, as a group, are more intimately involved than fathers with their child's development, actions, and thoughts.[5] Their "vested interests" in their children are presumably greater than the fathers', and they are consequently deemed both more responsible for and more knowledgeable about their children's behavior.

However plausible these assumptions, their validity may be questioned on several grounds. First, many workers have had the experience of finding that fathers are sometimes considerably more "workable" than mothers, both in terms of the reliability of the information they communicate about life in the family and the use they are able to make of collateral counseling. An extreme but not uncommon example of this phenomonen is noted in working with parents of schizophrenic children. The question arises too, as to whether clinics are not, in practice, usually so implicitly oriented toward the mother and her role in the child's maladjustment that little empirical exploration of the

From Madigan Army Hospital, Tacoma, Wash. Reprints should be requested from Capt. Lauterbach, Neuropsychiatric Department, Walter Reed Army Hospital, Washington, D. C.

father's role is attempted, especially in those cases where financial and marital conflicts in the home are not obviously noted.

Most important, however, is the fact that, in any actual contact with parents, the clinic is confronted by distinct personalities whose behaviors are only partially dependent upon their parental role as mothers or as fathers. In this context, the issue of what kind of persons they are and what attitudes they hold may be more important than whether they are mothers or fathers. The answer to this problem may determine the effectiveness of any help which the clinic can offer the child and the family through the parents. This issue must be resolved by a study of the individual parents. Is this person truthful, naive, deceitful? Does he or she manifest a defensive, open, or critical attitude—toward self, spouse, child, or clinic? Is the parent eager and motivated for help, or skeptical or indifferent regarding his own involvement in the child's difficulties?

In an attempt to approach the above questions empirically, the performance of 64 mothers and 46 fathers on the so-called validity scales (L, F, and K scales) of the Minnesota Multiphasic Personality Inventory[4] were analyzed. These scales, which are part of a self-attitude questionnaire, include respectively measures of: (1) truthfulness; (2) a self-critical attitude, indicative of rational and pertinent self-evaluations; and (3) defensiveness. Parents were selected consecutively as their children were referred to a military child guidance clinic over a six-month period.

It was found that the performance of the two groups, in terms of the test's standards for normal performance, were generally the same as would be found in the population at large.[6] It also was found that, in general, there were only small differences between the performance of mothers and fathers.

One exception to the above, however, was discovered. It was noted that mothers tend to be somewhat less truthful or more naive than fathers, as measured by the lie scale, although the overlap of scores of these groups even on this scale was considerable. The mean score of the mothers on this scale was significantly greater than that of the fathers ($t = 3.10$, $P < .05$). Mothers and fathers, as a group, were not distinguishable in their mean scores on scales which measure self-critical attitudes, and subtle ego-defensive tendencies (F and K scales respectively), but mothers were more variable on all scales, particularly on the K scale of ego-defensiveness ($F = 2.06$, $P < .05$).

## IMPLICATIONS FOR CLINIC OPERATION

The ramifications of these findings are apparent at three levels of clinic operation; the intake process, the collateral treatment process, and the disposition process.

*Intake.* At the intake level, a case history is routinely obtained; this history then becomes a primary datum for the clinic, exerting some influence on every further aspect of the clinic's decisions in relation to the subject family. Its reliability and validity is therefore of great importance. In most situations, it is commonly assumed, *a priori,* that more "complete" historical data is available from the mother than from the father. While this may well be so with respect to many important aspects of the child's development, it may be far from the truth with respect to equally critical aspects of the ongoing relationships between child and parents. In terms of the highly personal communications which must often be obtained from parents, our data suggest that the average father is more "truthful" and no more personally defensive in his self-evaluations than his spouse. A practical measure suggested by these data is therefore, that in obtaining information about critical personal interactions of child with parents, it is well to make no assumptions about the adequacy of information available from either parent and to interview both, as is suggested in a recent article.[1] However valid the culturally defined role of mother as the most significant figure, her status as the more adequate informant is questionable.

*Treatment.* At the collateral treatment level, the limited facilities, both in terms of time and personnel, often make the agency's selection of a single parent to be worked with one of crucial importance. In such instances, it is often wise to work, not with the parent who *needs* the service the most, in the sense of being the most critically troubled or malfunctioning, but with the parent who can *use* service the most, in benefiting all the affected members of the family. Here too, the usual assumption is that this parent is the mother, not the father,[7] and again our results contest the validity of this notion. The equal rationality, pertinence, and frankness of fathers and mothers in their self-evaluations may indicate that the former are as susceptible as their wives to rapid assimilation of the benefits of treatment. The point, here too, is that the case must be judged on its individual merits rather than from any doctrinaire position.

*Disposition.* Finally, problems of disposition require careful consideration. Not only must child guidance clinics frequently refer families to other agencies for a variety of diagnostic and therapeutic services, but they also are often in the position of having to offer suggestions which infringe on the sensibilities of the parents, such as recommendations for institutionalization in mental hospitals, or homes for the retarded, or foster home placement. In most such cases, the authority of the military child guidance clinic is quite strictly limited to making the recommendation to the parents, who must themselves assume the responsibility for acting on it. Here, more than in other functions, it is the attitude, not the role, of the parent, which will determine whether or not the recommendation will be followed. When the respective attitudes of the father and mother differ

greatly, as is often the case, it is important for the clinic to direct recommendations toward the parent who is most open and receptive to them and who is best able to judge their importance and undertake the responsibility of helping the spouse to understand and accept them. In this way, the less defensive and better motivated parent may be a real aid to the worker in facilitating adequate disposition. Our data suggest, here too, that the problem of assessing which parent is most amenable is an individual matter that must be separately ascertained in each case.

## SUMMARY

The aim of this study was to establish empirically whether the mothers and fathers of children referred to a military child guidance clinic differ significantly in attitudes which indicate relative susceptibility to counseling and psychotherapy. The "validity" scales (L, F, and K) of the Minnesota Multiphasic Personality Inventory, which attempts to measure truthfulness, self-critical attitudes, and defensiveness, respectively, were employed as criterion measures. These were administered to 110 consecutively selected parents, including 64 mothers and 46 fathers, referred to the child guidance clinic at this hospital for a wide variety of child problems.

Performances of mothers and fathers did not differ widely on the scales of self-critical attitudes (F) or defensiveness (K), but mothers obtained significantly higher mean scores on the truthfulness (L) scale.

Implications of these findings for intake, treatment, and disposition procedures were discussed, and the common practice of relying more exclusively on mothers than fathers in these clinic operations was questioned. In general, it was concluded that the individual attitudes of both parents, rather than the formal maternal or paternal role, should be assessed early in the case evaluation process and serve as the operational criterion for determining with which parent, or both, further extensive guidance work should be conducted.

## REFERENCES

1. Zehrer, F. A.: Child guidance clinic: principles and criteria for establishment and evaluation. *U. S. Armed Forces M. J.* 9: 1161-1167, Aug. 1958.

2. Buxbaum, E.: Technique of child therapy: a critical evaluation. In Eissler, R. S., and others (editors): *The Psychoanalytic Study of the Child.* International Universities Press, New York, N. Y., 1954. Vol. IX, pp. 297-333.

3. Montague, E. K., and Thompson, W. W.: Child guidance clinic in Army hospital. *U. S. Armed Forces M. J.* 4: 1753-1766, Dec. 1953.

4. Powers, D.; Washington, S.; and Lucero, J.: Modified child guidance program in Air Force hospital. *U. S. Armed Forces M. J.* 8: 1653-1657, Nov. 1957.

5. Levy, D. M.: *Maternal Overprotection.* Columbia University Press, New York, N. Y., 1943. pp. 3-5.

6. Hathaway, S. R., and McKinley, J. C.: *Minnesota Multiphasic Personality Inventory Manual.* The Psychological Corporation, New York, N. Y., 1951. p. 12.

7. Lippman, H. S.: *Treatment of the Child in Emotional Conflict.* McGraw-Hill Book Company, Inc., New York, N. Y., 1956. pp. 25-26.

# Hypofibrinogenemia Following Severe Spontaneous Abruptio Placentae

IVAN H. BOX, *Captain, MC, USAR*
IAN K. EDWARDS, *Captain, MC, USA*
WILLIAM M. LEEN, *Major, MC, USAR*

HYPOFIBRINOGENEMIA producing a hemorrhagic state in pregnancy may accompany cases of severe abruptio placentae, intrauterine retention of dead fetus, and amniotic fluid embolism. The manner in which the fibrinogen depletion occurs is not fully understood.

Page, Fulton, and Glendening[1] advocated the theory that this depletion of fibrinogen is caused by excessive liberation of thromboplastin from the placenta and decidua. The thromboplastin being forced into the maternal circulation is considered to cause conversion of prothrombin to thrombin, which in turn converts fibrinogen to fibrin. The fibrin then is deposited in the blood vessels of the maternal circulatory system.

Stouffer and Ashworth[2] offered the theory that hypofibrinogenemia results from large amounts of fibrin being deposited in the intervillous spaces of the placenta and on the maternal surface of the detached placenta. The presence of fibrin emboli found in other organs then would be explained by the detachment of patches of fibrin from the placenta.

Sandmire and Covalesky[3] stressed the importance of having on hand an available supply of fibrinogen, even in isolated station hospitals. The following case is presented to re-emphasize how urgent the need for fibrinogen may become if one of the obstetric accidents gives rise to hypofibrinogenemia.

## CASE REPORT

A 33-year-old Caucasian woman, para 3, gravida 10, abortus 6, was admitted to this hospital at 0500 hours, 28 May 1958, complaining of constant abdominal pain of two hours' duration. Her estimated day of confinement was 28 June. The patient had been awakened at 0300 hours with constant cramping pain in the lower abdomen and a feeling of extreme weakness. En route to the hospital at about 0430 hours, she had noted a sudden gush of blood from the vagina.

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From Valley Forge Army Hospital, Phoenixville, Pa.

The patient had been followed regularly in the prenatal clinic since 16 December 1957. Her total weight gain was 15 pounds, her blood pressure had been in the normal range of 120/70 mm Hg, and urinalyses had been negative. Her blood was type O, Rh positive, with a hemoglobin of 10.7 grams per 100 ml. Past history revealed that she had had six successive spontaneous abortions following the delivery of her first child, but no complications with the remaining pregnancies.

On admission, examination revealed a markedly pale gravid woman appearing to be in acute distress. There was evidence of about 1,000 ml of bright red blood in the linen of the ambulance litter, and there was moderate continuous bleeding from the vagina. The patient's blood pressure was 110/70 mm Hg; pulse rate, 100 per minute; and respirations, 30 per minute. The fundus uteri was 30 cm above the symphysis pubis and rigid. Fetal parts could not be outlined and fetal heart was not heard.

A 500 ml unit of dextran intravenously was started at once. The initial blood specimen revealed hemoglobin of 9.8 grams per 100 ml and a specimen of blood placed in a clean test tube did not form a clot. Blood was noted to be oozing from the venous puncture sites. Between 0600 hours and 0700 hours, 1,000 ml of preserved whole blood and 1 gram of fibrinogen was given intravenously. A fibrinogen determination on blood specimen drawn at 0700 hours revealed no demonstrable fibrinogen. Vaginal examination at 0700 hours revealed the cervix 50 per cent effaced and 1 cm dilated. The vertex was presenting at −1 station. An attempt to rupture membranes was unsuccessful.

Between 0700 hours and 1000 hours the patient was given 1,000 ml of fresh whole blood to replace the estimated loss per vagina since admission. During this time she also was given an additional 4 grams of fibrinogen. At 1100 hours uterine contractions were occurring every 3 or 4 minutes, vaginal examination revealed the cervix dilated 3 cm, and amniotomy was performed.

Fibrogen level at 1100 hours was 112 mg per 100 ml. Labor progressed satisfactorily and spontaneous delivery of a stillborn infant, weighing 5 pounds 9 ounces, occurred at 1600 hours. Demerol hydrochloride, 100 mg, was used for sedation and caudal anesthesia was given at 8 cm dilation of the cervix. About 1,500 ml of blood and fluid was expressed with the placenta immediately following delivery of the baby. The placenta appeared to have been 100 per cent prematurely separated from the uterus. An additional 1,000 ml of fresh whole blood and 1 gram of fibrinogen was given during the second stage of labor and early postpartum period. An intravenous infusion containing pitocin was started following delivery and the uterus remained contracted and bleeding subsided. The fibrinogen level at 1600 hours was 225 mg per 100 ml.

Urine output during the first 8 hours consisted of 40 ml of grossly bloody urine; however, the rate gradually increased to normal within 12 hours following admission. On the first postpartum day the patient developed a pneumonitis in the right lung base and spiked

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104°F temperature, but promptly responded to antibiotics. An additional 500 ml of preserved whole blood was given on the first postpartum day. The hemoglobin on the second postpartum day was 10 grams per 100 ml. The remainder of the postpartum course was uneventful, and examination at six weeks postpartum revealed normal involution of the uterus and the patient was asymptomatic.

## DISCUSSION

In review of 11 cases of abruptio placentae and hypofibrinogenemia, Pritchard[4] showed that blood loss is not excessive from the site of placental implantation if sufficient myometrial tone can be maintained. Also, the fibrinogen concentration can be expected to return to an effective level within 8 to 12 hours after the uterus is emptied, even without fibrinogen having been administered. Homologous serum jaundice has been observed to occur in approximately 5 per cent of patients receiving fibrinogen. Since this condition may be fatal, fibrinogen must not be administered indiscriminately.

If there is inadequate clot formation in the clot observation test or if the plasma fibrinogen level approaches 100 mg per 100 ml or less, the deficit should be corrected prior to any operative procedure. Three to six grams of fibrinogen will usually be required to correct this deficit. The case presented here again demonstrates the necessity of having fibrinogen readily available on all obstetric services because its use is mandatory in cases of abruptio placentae with severe hypofibrinogenemia, or in refractory cases where delivery must be performed via the abdominal route.

## SUMMARY

A case of hypofibrinogenemia with profuse hemorrhage following severe abruptio placentae is presented, including a brief discussion of the cause. Fibrinogen should be readily available on all obstetrical services and given only when a significant deficiency is demonstrated.

## REFERENCES

1. Page, E. W.; Fulton, L. D.; and Glendening, M. B.: Cause of blood coagulation defect following abruptio placentae. *Am. J. Obst. & Gynec.* 61: 1116-1122, May 1951.

2. Stouffer, J. G., and Ashworth, C. T.: Hypofibrinogenemia and placenta. *Am. J. Obst. & Gynec.* 75: 407-417, Feb. 1958.

3. Sandmire, H. F., and Covalesky, B. M.: Afibrinogenemia resulting from amniotic fluid infusion. *U. S. Armed Forces M. J.* 7: 1351-1355, Sept. 1956.

4. Pritchard, J. A.: Abruptio placentae and hypofibrinogenemia. *Am. Obst. & Gynec.* 76: 347-362, Aug. 1958.

# False Positive Spinal Fluid Kahn Test in Infectious Mononucleosis

HAROLD J. SOBEL, *Lieutenant, MC, USNR*
ROBERT B. SIMONS, *Captain, MC, USN (Ret.)*

CLINICIANS are no longer surprised at the myriad of ways in which infectious monocleosis may present itself.[1] Biologic false positive reactions to serologic tests for syphilis in infectious monocleosis are common.[1-8] Recently we studied a case in which the initial manifestation was a positive Kahn reaction of high titer in an otherwise asymptomatic young adult male. The cerebrospinal fluid also gave a positive Kahn reaction, and the patient underwent treatment for syphilis. Admission blood smear showed a slight lymphocytosis and a few atypical lymphocytes (table 1). Other stigmata of infectious mononucleosis were absent. Inasmuch as a biologic false positive reaction for syphilis of cerebrospinal fluid had never, as far as we know, been reported in infectious mononucleosis, this case was considered one of early, latent, seropositive syphilis with possible concomitant infectious mononucleosis.[9-13] It was not until numerous serologic procedures for the diagnosis of infectious mononucleosis were reported as positive (table 2), and the *Treponema pallidum* immobilization test negative that we knew the positive Kahn reaction in the cerebrospinal fluid in this instance could not be attributed to syphilis (table 3).

## CASE REPORT

A 20-year-old white seaman was admitted to this hospital on 21 February 1958 with a diagnosis of syphilis, latent, early, seropositive. Prior to admission, while undergoing a physical examination for college entrance, this otherwise asymptomatic young man was found on two occasions to have positive reactions to serologic tests for syphilis, and was transferred to this hospital for further studies. The patient had several sexual contacts in October and November of 1957, but never had any symptoms or signs of venereal infection such as skin erruption, genital discharge, or genital or extragenital lesions.

Family history and review of systems were noncontributary. Past history revealed that the patient had a negative presumptive Kahn in

From the U. S. Naval Hospital, Jacksonville, Fla. Dr. Sobel is now at Mount Sinai Hospital, New York, N. Y.

TABLE 1. *Hematologic data*

| Date | White blood cells (per μl) | Differential count in per cent | | | | | | Hemoglobin (grams/100 ml) | Hematocrit (ml/100 ml) |
|---|---|---|---|---|---|---|---|---|---|
| | | Neutrophils | Lymphocytes | Atypical lymphocytes | Monocytes | Eosinophils | Basophils | | |
| 2-24-58 | 5,700 | 46 | 49 | few | 4 | - | 1 | 15.5 | 42 |
| 2-28-58 | 7,400 | 37 | 61 | many | 1 | 1 | - | 16.7 | 45 |
| 3-4-58 | 6,600 | 50 | 40 | - | 3 | 7 | - | 17.4 | 46.5 |
| 3-11-58 | 6,200 | 47 | 46 | - | 5 | 2 | - | | |
| 4-21-58 | 8,850 | 55 | 39 | - | 4 | 2 | - | 14.2 | 42 |

TABLE 2. *Results of serologic tests for infectious mononucleosis*

| Date | Sheep erythrocyte agglutinin test (a) | | | Sheep erythrocyte agglutinin test (b) | | | | Beef erythrocyte |
|---|---|---|---|---|---|---|---|---|
| | Serum unabsorbed | Serum absorbed with | | Serum unabsorbed titrated with | | Serum absorbed with papain-treated sheep erythrocytes titrated with | | Hemolysin test (c) |
| | | Guinea pig kidney | Boiled beef erythrocytes | | | | | |
| | Presumptive test | Differential test | | Untreated erythrocytes | Papain-treated erythrocytes | Untreated erythrocytes | Papain-treated erythrocytes | |
| 2-24-58 | 3584 | | | | | | | |
| 2-26-58 | 1792 | | 56 | | | | | |
| 3-4-58 | 896 | 448 | 0 | 896 | 448 | 448 | 14 | 560 |
| 3-19-58 | 112 | | | | | | | |
| 4-21-58 | negative | | | | | | | |

(a) According to the method of Davidsohn.[14]
(b) Modified method of Wöllner.[15]
(c) Modified method of Peterson, Walford, and Figueroa.[16]

TABLE 3. *Results of serologic tests for syphilis*

| Date | Presumptive Kahn | Standard Kahn | Quantatative Kahn | Cerebrospinal fluid Kahn | Treponema pallidum immobilization |
|---|---|---|---|---|---|
| 2-18-58 | positive | 4 | | | |
| 2-19-58 | positive | 4 | | | |
| 2-21-58 | | | 128 | positive | |
| 2-24-58 | | | 64 | | |
| 2-26-58 | | | | | negative |
| 3-14-58 | | | 64 | | |
| 3-19-58 | | | 32 | | |
| 4-21-58 | | negative | | | |
| 4-23-58 | | | | | negative |

October 1955 and donated blood in April and June 1956 and in April 1957, at which time serologic tests are assumed to have been negative. He received antibiotics only once, in December 1955, at which time he was given injections of 600 mg (600,000 units) of procaine penicillin G on three consecutive days for a furuncle of the right elbow with right axillary adenopathy. The patient had not been ill during the year prior to admission. In the 14 months prior to admission he was seen by a physician only twice: in August 1957 for smallpox vaccination, triple typhoid and combined diptheria-tetanus toxoid boosters, and in September 1957 for Asian influenza vaccine. The only significant findings in the physical examination were a few small, shotty, palpable cervical lymph nodes.

The patient remained afebrile and asymptomatic throughout his hospital stay. At no time were hepatosplenomegaly or lymphadenopathy noted. On admission his quantitative Kahn was 128 units (table 3). The initial cerebrospinal fluid pressure was 150 mm of water. The fluid was water-clear, total protein was 28 mg per 100 ml, globulin was not increased, 28 red blood cells were noted on microscopic examination, and the Kahn test was positive. The differential leukocyte count (table 1) revealed a slight lymphocytosis with a few atypical lymphocytes. This suggested the possibility of infectious mononucleosis. The heterophil agglutination on the same day was positive. At this time although the diagnosis of infectious mononucleosis with a biologic false positive reaction to serologic tests was entertained, concurrent syphilis and infectious monocleosis could not be ruled out. Two blood specimens for *Treponema pallidum* immobilization tests were drawn, and on 27 February the patient was placed on 600 mg (600,000 units) of procaine penicillin G daily for 10 days. This course of antisyphilitic therapy was begun principally on the strength of the positive reaction of the cerebrospinal fluid to the Kahn test and the history of sexual contact. Negative results of the *Treponema pallidum* immobilization tests were not expected, but both (26 February and 23 April) were negative. On 28 February the differential leukocyte count revealed a marked lymphocytosis with many atypical forms. By 4 March the blood cell count returned to normal. The cephalin cholesterol flocculation was transiently positive, but by 21 April this as well as the heterophil agglutination test for infectious mononucleosis and standard Kahn had become negative (table 2).

## DISCUSSION

We believe this is the first report of a case of infectious mononucleosis in which the cerebrospinal fluid gave a biologic false positive reaction to tests for syphilis. The clinical and laboratory findings previously described in this entity are legion. Bernstein[1] published an excellent review. The occurrence of biologic false positive reactions to serologic tests for syphilis in infectious mononucleosis has been well documented.[1-8] These have been reported in various series as occurring in from 2 to more than 60 per cent of cases. It has been thought that the wide variation in the reported percentage of biologic false positive reactions in infectious mononucleosis is explainable by the evanescent character of this finding. It has been assumed that if serologic tests were performed more frequently and persistently the incidence of positive reactions encountered would be considerably higher. The absence of cerebrospinal fluid giving biologic false positive reactions in tests for syphilis in infectious mononucleosis probably can not be explained by infrequent testing alone, inasmuch as neurologic manifestations of infectious mononucleosis occur frequently and many cerebrospinal fluid examinations have been performed in this disease.

It therefore must be assumed that this finding is extremely uncommon.

On occasion, a patient has been found to have both syphilis and infectious mononucleosis.[9-13] During the era of arsenical therapy for syphilis numerous reports of a syndrome identical with infectious mononucleosis were recorded in patients undergoing antisyphilitic therapy.[9,10] This syndrome also has been reported in persons with syphilis not yet under treatment,[11-13] and we believe it is unrelated to the therapy.

It is thought that in our patient the negative *Treponema pallidum* immobilization tests adequately ruled out a concurrent syphilitic infection, and that the patient had only a single disease process: infectious mononucleosis.

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ACKNOWLEDGMENT: The authors are indebted to Drs. I. Davidsohn and C. L. Lee for their help in performing various serologic procedures and reviewing this material.

REFERENCES

1. Bernstein, A. (Baltimore): Infectious mononucleosis. *Medicine* 19: 85-159, Feb. 1940.

2. Bernstein, A. (Baltimore): Antibody responses in infectious mononucleosis. *J. Clin. Investigation* 13: 419-435, May 1934.

3. Bernstein, A. (Baltimore): False-positive Wassermann reactions in infectious mononucleosis. *Am. J. M. Sc.* 196: 79-83, July 1938.

4. Gooding, S. E. F.: On glandular fever or infective mononucleosis. *Practitioner* 127: 468-483, Oct. 1931.

5. Hatz, B.: Wassermann reaction in infectious mononucleosis, with report of case with unusual clinical features. *Am. J. Clin. Path.* 8: 39-45, Jan. 1938.

6. Saphir, W.: Wassermann reaction in infectious mononucleosis. *Am. J. Clin. Path.* 9: 306-310, May 1939.

7. Sadusk, J. F., Jr.: Temporarily positive Kahn and Wassermann reactions in infectious mononucleosis; report of case. *J. A. M. A.* 112: 1682-1683, Apr. 29, 1939.

8. Kaufman, R. E.: False positive serologic reactions for syphilis in infectious mononucleosis *J. Lab. & Clin. Med.* 26: 1439-1446, June 1941.

9. White, E. C.: Lymphadenosis, acute benign disease simulating acute leukemia. *U. S. Nav. M. Bull.* 22: 302-307, Mar. 1925.

10. Baldridge, C. W.; Rohner, F. J.; and Hansmann, G. H.: Glandular fever (infectious mononucleosis). *Arch. Int. Med.* 38: 413-448, Oct. 1926.

11. Eismayer, G., and Putschar, W.: Über das lymphämoide Drüsenfieber (Glanzmann) und Erkrankungen mit ähnlichem Blutbild. (Ein Beitrag zur hämatologischen Methodik). *Ztschr. f. klin. Med.* 120: 272-312, 1932.

12. Farley, D. L.: Acute infectious mononucleosis. *M. Clin. North America* 21: 1139-1151, July 1937.

13. Zarafonetis, C. J. D.: Occurence of infectious mononucleosis and syphilis in same individual. *Ann. Int. Med.* 38: 1053-1057, May 1953.

14. Davidsohn, I.: Test for infectious mononucleosis. *Am. J. CLin. Path., Tech. Supp.* 2: 56-60, Mar. 1938.

15. Wöllner, D.: Über die serologische Diagnose der infektiösen Mononuklease nach Paul-Bunnell mit nativen und fermentierten Hammelerythrocyten. *Ztschr. Immunitätsforsch* 112: 290-308, Nov. 1955.

16. Peterson, E. T.; Walford, R. L.; and Figueroa, W. G.: Ox cell hemolysins in infectious mononucleosis and in other diseases. *Am. J. Med.* 21: 193-199, Aug. 1956.

## TWITCHELL PROMOTED TO MAJOR GENERAL, BEDWELL, BRUA AND MORHOUSE GET STARS

Major General Harold H. Twitchell, command surgeon of the United States Air Forces in Europe, recently received his second star, and Brigadier Generals Charles H. Morhouse, Theodore C. Bedwell, Jr., and Robert S. Brua, USAF (MC), have been promoted from the rank of colonel.

General Twitchell was surgeon of the Continental Air Command, Mitchel Air Force Base, New York, prior to his assignment in Europe. From 1953 to 1955 he served as director of professional services in the office of the Air Force surgeon general. He is a 1929 graduate of the University of Vermont School of Medicine, and a former commander of Tripler Army Hospital.

*Gen. Twitchell*

*Gen. Bedwell*

*Gen. Brua*

*Gen. Morhouse*

General Morhouse was recently appointed Surgeon of the Fifth Air Force in Japan after serving as surgeon of the Air Proving Ground Command, Eglin Air Force Base, Florida. At the fall of Bataan, during World War II, he accompanied General Douglas MacArthur by submarine to Australia, where he served as aide de camp and personal physician from March 1942 to 1945. He is a 1933 graduate of the University of Vermont School of Medicine.

General Bedwell has been deputy surgeon of the Strategic Air Command, Offutt Air Force Base, Nebraska, for the last three years. Previously, he was chief of the preventive medicine division, office of the Air Force surgeon general. He received his medical degree from Baylor University Medical College in 1933, and master of public health from Johns Hopkins University in June 1951.

General Brua has served as chief of the medical inspection division, in the office of the Air Force inspector general, Norton Air Force Base, California, since August 1957. He formerly was surgeon of the Western Air Defense Force, Hamilton Air Force Base, California. A graduate of Washington University School of Medicine in 1931, he is a specialist in orthopedic surgery.

**FAREWELL CEREMONY.** Major General Silas B. Hays, former Surgeon General of the Army, is shown presenting a letter of personal appreciation of General James P. Cooney, his Deputy Surgeon General, at a farewell ceremony 30 April 1959. General Cooney has been assigned as chief surgeon, Headquarters U. S. Army Europe. General Hays, retires 31 July to become area medical officer and director of the blood program in the eastern area for the American Red Cross.

## DENTAL JOURNAL ANNOUNCES NEW SECTION

A section devoted to the dental profession of the Department of Defense and U. S. Public Health Service was recently announced as a new department of *Oral Surgery, Oral Medicine and Oral Pathology,* a monthly publication. The staff of the new section includes: Major General James M. Epperly, DC, USA, chief of the Army Dental Corps; Colonel Joseph L. Bernier, DC, USA, director of the Dental and Oral Pathology Division, Armed Forces Institute of Pathology, Washington, D. C.; Rear Admiral Curtiss W. Schantz, DC, USN, assistant chief for dentistry, Bureau of Medicine and Surgery; Captain Theodore A. Lesney, DC, USN, chief of dental service, U. S. Naval Hospital, San Diego, California; Major General James S. Cathroe, USAF (DC), assistant for dental services, office of the Air Force surgeon general; Colonel Donald C. Hudson, USAF (DC), chief of the dental sciences division, U. S. Air Force School of Aviation Medicine.

# BABIONE RETIRES FROM NAVY, SUCCEEDED BY RIZZOLO AS AFEB EXECUTIVE SECRETARY

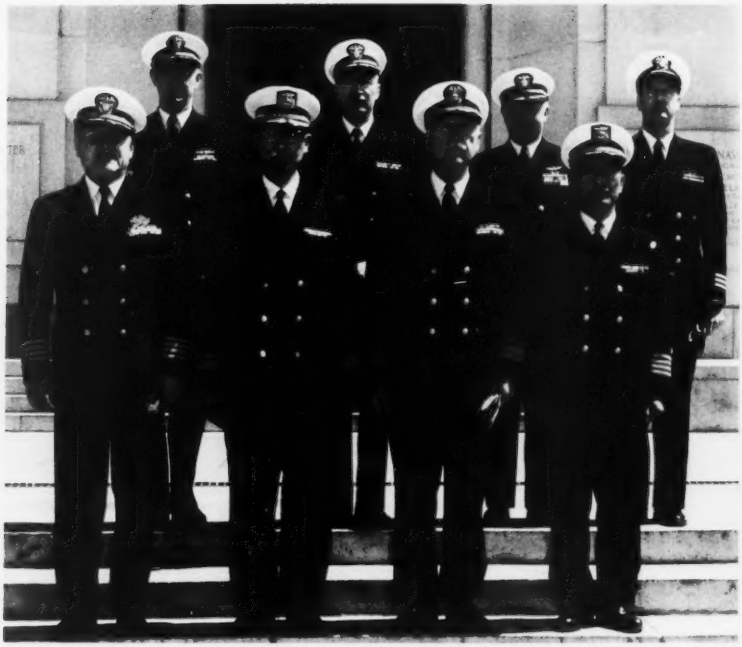
Colonel John Rizzolo, USAF (MC), has been named executive secretary of the Armed Forces Epidemiological Board to succeed Captain Robert W. Babione, MC, USN, who retired on 30 June after more than 29 years of naval service. Colonel Rizzolo has been assistant executive secretary since early 1958.

*Colonel Rizzolo*

*Captain Babione*

During his assignment as executive secretary since 1955, Captain Babione has effected closer cooperation between the military services in epidemiological activities and medical research, and has been active in assisting civilian research consultants in military problems. The board's services to the military establishments have doubled during this period. A 1930 graduate of Western Reserve University School of Medicine, Captain Babione received the degree of master in public health from Johns Hopkins University in 1948. He served as a liaison officer for AFEB from 1949 to 1952 when he was director of the preventive medicine division of the Bureau of Medicine and Surgery.

The first Air Force officer to serve as executive secretary of the triservice board, Colonel Rizzolo received the doctor of medicine degree from the University of Maryland in 1938 and his master's degree in public health from Tulane University in 1949. He was certified in public health by the American Board of Preventive Medicine in 1950. He holds the aeronautical rating of senior flight surgeon. He has served as preventive medicine officer of U. S. Air Forces in Europe, and as hospital commander at Laon Air Base, France.



**JAPANESE NAVY SURGEON GENERAL.** Rear Admiral Yukioni Abe, Surgeon General of the Japanese Navy, J. S. D. F., (first row, second from left), is shown during his recent tour of the facilities at the National Naval Medical Center in Bethesda, Md. Standing with him, left to right, are: (first row) Rear Admiral Frank P. Kreuz, Jr., MC, USN, commanding officer of the U. S. Naval Hospital; Rear Admiral Thomas F. Cooper, MC, USN, commanding officer, National Naval Medical Center; and Captain Ishida, Naval Attache, Japanese Embassy. (Second row) Captain Otto Van Der Aue, MC, USN, commanding officer, Naval Medical Research Institute; Captain Eric G. F. Pollard, DC, USN, commanding officer, U. S. Naval Dental School; Captain Lester J. Pope, MC, USN, commanding officer, U. S. Naval Medical School; and Commander Calvin F. Johnson, MSC, USN, commanding officer of the U. S. Naval School of Hospital Administration.

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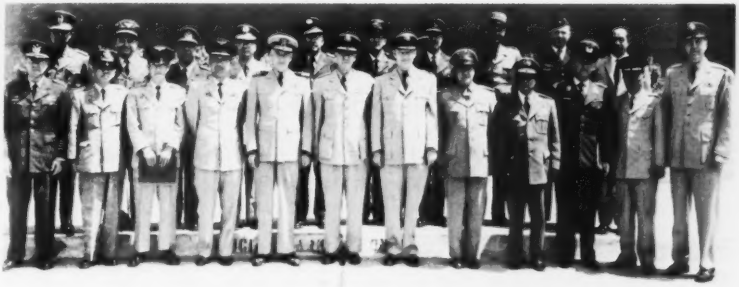
## WALTER REED TO INSTALL NUCLEAR REACTOR

A 50,000-watt nuclear energy reactor for biological research and medical treatment has been designed for Walter Reed Army Institute of Research by Atomics International under an agreement with the Army Corps of Engineers, and will be installed sometime next summer.

# AIR OFFICERS OF 16 COUNTRIES GUESTS OF GEN. NIESS ON USAF MEDICAL TOUR

The surgeons general or senior medical officers of 16 foreign air forces were the official guests of the U. S. Air Force for a tour of selected medical facilities following the recent annual meeting of the Aerospace Medical Association in Los Angeles. They were escorted by Major General Oliver K. Niess, surgeon general of the Air Force.

The group visited the U. S. Air Force School of Aviation Medicine, Randolph Air Force Base, Texas, Lackland Air Force Base, Texas, Maxwell and Gunter Air Force Bases, Alabama, the Aero Medical Laboratory, Wright-Patterson Air Force Base, Ohio, and the Armed Forces Institute of Pathology, Washington, D. C., where the accompanying photograph was taken.



*First row: (left to right) Col. Marcial Baeza, deputy director of medical services, Chilean Air Force; Maj. Gen. Yasuo Obmura, Japanese Self Defense Force; Maj. Park Kyong Wha, Republic of Korea Air Force; Brig. Gen. Chang Duk Sung, surgeon general, Republic of Korea Air Force; Capt. William M. Silliphant, director, Armed Forces Institute of Pathology; Maj. Gen. Oliver K. Niess, surgeon general, U. S. Air Force; Col. Frank M. Townsend, deputy director, AFIP; Brig. Gen. Raul Terres Prieto, surgeon general, Mexican Air Force; Col. Pelagio G. Potenciano, air surgeon general, Phillipine Air Force; Col. Fritz Dorener, German Air Force, Republic of West Germany; Col. Chang Pyung Kun, Republic of Korea Air Force; Col. Clyde Currier, USAF (MSC), escort officer. Second row: (left to right) Brig. Gen. Cesar Gagliardone, chief Paraguayan Armed Forces Medical Service; Maj. Raphael Benchimol, Brazilian Air Force; Col. Olimpo Molina, Chilean Air Force; Maj. Gen. Li Hsu-Chu, surgeon general, Nationalist Chinese Air Force; Capt. Humberto Segundo Romero Ruiz, Venezuelan Air Force; First Lt. Alberto del Castillo y Guerra, Cuban Air Force; Brig. Gen. Victorio Vincente Olguin, director general health services, Argentine Air Force; Capt. Urs Baumann, Swiss Institute of Aviation Medicine; Lt. Col. Arne Frykholm, Royal Swedish Air Force; Dr. H. Velarde, University of East Medical School, Phillipine Islands. Not shown in the picture are: Air Commodore A. A. G. Corbet, director general of medical services (Air), Royal Canadian Air Force; Wing Comdr. J. C. Wickett, Canadian Joint Staff Washington; Maj. Hubertus Grunhofer, German Air Force; Brig. Gen. Abbas Aghili, surgeon general, Imperial Iranian Air Force; and Air Commodore Tragool Thavaravej, deputy surgeon general, Royal Thai Air Force.*

## GEN. ST. JOHN TO COMMAND WALTER REED

*General St. John*

Brigadier General Clement F. St. John, MC, USA, has been named commanding general of Walter Reed Army Medical Center to succeed Major General Leonard D. Heaton, surgeon general of the Army. Major General Alvin L. Gorby, MC, USA, chief surgeon of U. S. Army in Europe, who had been announced as General Heaton's successor, is the new commander of Valley Forge Army Hospital, Phoenixville, Pennsylvania.

A native of Jamestown, Ohio, General St. John, received his medical degree from Ohio State University in 1928, and began his Army service the same year. He was commissioned as a first lieutenant in the Medical Corps of the Regular Army in 1930. Prior to his assignment to Brooke Army Hospital, he was commander of the Ninth Hospital Center, Landstuhl, Germany, after serving as deputy surgeon, U. S. Army in Europe from 1955 to 1957. He was chief of the medical plans and operations division in the office of the Army surgeon general before going to Europe. During World War II he was assistant surgeon of the Western Task Force, and executive officer and operations officer successively for the 5th Army Surgeon, taking part in the invasion of Salerno, Italy. He is a fellow of the American College of Physicians and has been awarded the Legion of Merit.

General St. John will be succeeded at Brooke Army Hospital by Brigadier General James L. Snyder, MC, USA, who has been commanding general of Valley Forge Army Hospital.

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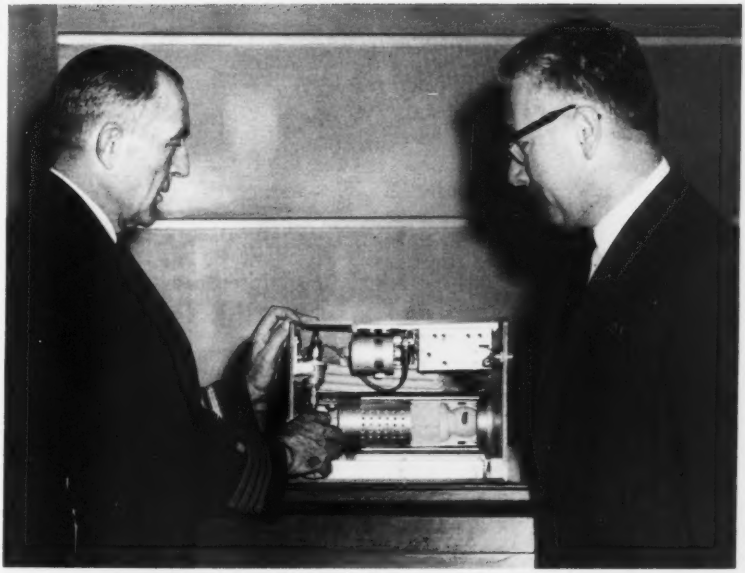
## MILITARY ENTOMOLOGY COURSE OFFERED

A two week course in military entomology will be conducted by the Armed Forces Pest Control Board, 3-16 August 1959, at the U. S. Naval Medical School, Bethesda, Maryland. Attendance at this second annual course has been limited to 30 participants, including military entomologists, active and reserve, and civilians.

Among the objectives of the course are advanced training in military entomology and stimulation of research in related basic and applied problems.



**ARTIFICIAL ENVIRONMENT.** Captain Norman L. Barr, MC, USN, director of the Astronautical Division of the Navy's Bureau of Medicine and Surgery, and Dr. Dietrick Beischer, head of the biophysical laboratory at the School of Aviation Medicine, Pensacola, Florida, are shown with the "bio-pac capsule" used in the flight of the monkey, "Old Reliable," into space 13 December 1958. The monkey and capsule reached an altitude of 300 miles and traveled about 1,500 miles, but were not recovered.

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## ARMY PRESENTS MASS CASUALTY PROGRAM AT AMA MEETING

A condensed version of the Army Medical Service course in management of mass casualties was presented under the sponsorship of the Council on National Defense of the American Medical Association as part of the Medical Civil Defense Conference in Atlantic City prior to the annual meeting of the Association on 8-12 June. Participating in the program were the following Army Medical Corps officers: Surgeon General Leonard D. Heaton; Colonels Albert J. Glass, Philip R. Beckjord, and Theodore M. Carow, all from the office of the Army surgeon general; Colonel Roy D. Maxwell and Lieutenant Colonels H. Haskell Ziperman, Edward H. Vogel, and Major Jack C. Fitzpatrick, Brooke Army Medical Center, Fort Sam Houston, Texas; Lieutenant Colonels Joseph D. Goldstein and William H. Moncreif, Jr,, Walter Reed Institute of Research; and Colonel William D. Tigertt, Fort Detrick, Maryland. Lieutenant Colonel Vincent I. Hack, MSC, Brooke Army Medical Center, was the only Medical Service Corps officer on the program.

# GEN. HARTFORD NAMED DEPUTY ARMY SG

*General Hartford*

Brigadier General Thomas J. Hartford, MC, USA, commanding general of Madigan Army Hospital, Tacoma, Washington, has been named Deputy Surgeon General of the Army. He succeeds Major General James P. Cooney, MC, USA, who was recently assigned to Europe.

Prior to his assignment to Madigan Army Hospital, General Hartford served as deputy commander of Walter Reed Army Medical Center from 1951 to 1955. He has also served as executive officer to the Army Surgeon General. and during World War II as deputy surgeon of the European theater, and later as surgeon of the Third Army.

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**NEW ASSIGNMENTS.** Colonel Larry A. Smith, USAF (MC), left, recently succeeded Brigadier General M. S. White, USAF (MC), right, as director of medical staffing and education, office of the Air Force surgeon general. Colonel Smith, whose specialties are internal and aviation medicine, has been deputy director for the past year. General White, president of the Aerospace Medical Association for 1958-59, has been named surgeon of the Air Training Command.

**OFFICERS COMPLETE DENTISTRY COURSE.** Fourteen U. S. Army Dental Corps officers and four allied officers completed the advanced dentistry course at Walter Reed Army Institute of Research, Washington, D. C., and were presented with certificates of completion in a May ceremony. Shown accepting his diploma from Major General James M. Epperly, chief of the Army Dental Corps, center, is Captain Syed Agmat Hassain Naqvi, Pakistan Army dental officer. At left is Brigadier General Clarence P. Canby, director of dental activities at Walter Reed Medical Center.

## OFFICIAL DECORATIONS

The following awards were recently announced by the Department of the Air Force.

### Legion of Merit

Fratis L. Duff, Col., USAF (MC)*
Robert E. Lee, Brig. Gen., USAF (MC)*
Vernie A. Stembridge, Maj., USAF (MC)

### Air Force Commendation Medal

Keith H. Averill, Capt., USAF (MC)
Herbert W. Coone, Col., USAF (MC)
Harold V. Ellingson, Col., USAF (MC)
John D. Fulton, Lt. Col., USAF (MSC)
Leon T. Tayloe, Lt. Col., USAF (MSC)

*First oak leaf cluster

## DR. STOWELL NAMED AFIP SCIENCE DIRECTOR

*Dr. Stowell*

Dr. Robert E. Stowell, director of cancer research, and professor and chairman of the department of pathology and oncology, University of Kansas Medical Center for the past 11 years, has been appointed scientific director of the Armed Forces Institute of Pathology. He succeeds Ernest E. Goodpasture who resigned 10 April 1959.

Dr. Stowell has been a member of the Scientific Advisory Board of Consultants for the Armed Forces Institute of Pathology for the last three years, and is currently president of the International Academy of Pathology and chairman of the Intersociety Committee for Research Potential in Pathology. He is author or co-author of many published scientific papers. A native of Cashmere, Washington, Dr. Stowell was graduated from Stanford University School of Medicine in 1940 and received the degree of doctor of philosophy in pathology from Washington University in 1944. Prior to coming to the University of Kansas, he taught at the Washington University School of Medicine, and served as assistant pathologist at several hospitals in St. Louis.

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**NEW FORBES AFB HOSPITAL.** Opened in March, this new 100-bed Air Force hospital at Forbes Air Force Base, Kansas, will provide services in aviation medicine, general medicine, general surgery, obstetrics and gynecology, pediatrics, and radiology. Colonel Jack F. Burnett, USAF (MC), is commanding officer of the hospital.

# Progress Notes

Dr. **Frank B. Berry**, Assistant Secretary of Defense, (Health and Medical), was recently notified by Ambassador **Herve Alphand** of France that he has been made a *Chevalier* of the *Legion d'honneur*, the French order of knighthood, "as a token of the French government's great appreciation for the sentiment. . . shown for France on many occasions." . . . .The American Urological Association is offering three prizes totaling $1,000 for essays submitted before 1 December on the result of clinical or laboratory research in urology. Urologists who have been graduated not more than ten years, hospital interns and residents doing research work in urology are eligible. The executive secretary, **William P. Didusch**, 1120 North Charles Street, Baltimore, can provide details. . . . .The April 1959 issue of *Medical Annals of the District of Columbia* was a special Walter Reed Army Medical Center number, with scientific articles contributed by members of the medical center staff. Brigadier General **Francis W. Pruitt**, MC, USA, chief of the department of medicine, was consulting editor. Authors were the following Medical Corps officers: Colonels **Benjamin H. Sullivan, Jr.**, and **Ogden C. Bruton**; Lieutenant Colonels **Donald L. Howie, William H. Crosby, Jr., James B. Hartgering**, and **Hu A. Blake**; Major **Michael P. Dacquisto**, and Captains **John E. Meyers, Jr., Marcel E. Conrad, Jr., Harold S. Ramos**, and **Edward J. Kamin, III**. . . . .Rear Admiral **Bartholomew W. Hogan**, Surgeon General of the Navy, was recently appointed North American chairman of the Pan American Medical Association's section on military medicine. Major General **Otis O. Benson, Jr.**, USAF (MC), commanding officer of the U. S. Air Force School of Aviation Medicine, Randolph Air Force Base, Texas, has been appointed chairman of the new section on space medicine. . . . .Lieutenant Colonel **Ellis Arkus**, MSC, USA, succeeded Major **James A. Leddon, Jr.**, MSC, USA, as commanding officer of the 52d Medical Battalion, Seventh U. S. Army, Europe, on 8 May 1959. Major Leddon, commander of the 52d Battalion since August 1956, has been assigned to Fort Meade, Maryland, as a member of the 68th Medical Group. . . . .Former chief of the aviation pathology section, Armed Forces Institute of Pathology, Dr. **Vernie A. Stembridge**, was recently awarded the Legion of Merit for his services at AFIP from February 1956 to January 1959, while on active duty as a major in the U. S. Air Force Medical Service. Dr. Stembridge is associate professor of pathology at Southwestern Medical School, Dallas, Texas. . . . .Major General **James M. Epperly**, DC, USA, Army Dental Corps chief, recently returned from a three-week tour of dental installations in the Far East, including an inspection of facilities of the U. S. Army Advisory Group in Korea. . . . .Rear Admiral **Frank P. Kreuz, Jr.**, MC, USN, commanding officer of the U. S. Naval Hospital in Bethesda, Maryland, was promoted to flag rank in April. . . . . At Fort Benning, Georgia, **Robert M. Hardaway, III**, MC, USA, chief of the general surgical service at Martin Army Hospital, was recently

promoted to the rank of colonel. . . . .Thirty members of the Army Medical Specialist Corps attended the corps' ninth semiannual institute for officers 10-16 May, at Walter Reed Army Medical Center. Captain **Gertrude Murray**, AMSC, Walter Reed Army Hospital, was course director, and the chiefs of sections of the Army Surgeon General's office conducting workshop programs were: Lieutenant Colonel **Helen M. Davis**, dietitian section; Lieutenant Colonel **Myra L. McDaniel**, occupational therapist section; Lieutenant Colonel **Barbara R. Friz**, physical therapist section. . . . .Colonel **William F. Patient**, USAF (MC), has been assigned as surgeon of the Alaskan Air Command, succeeding Brigadier General **John R. Copenhaver**, USAF (MC), now surgeon, Tactical Air Command, Langley Air Force Base, Virginia. . . . Captain **Lynn S. Beals, Jr.**, MC, USN, retired 1 April after more than 20 years of active naval service. His last duty assignment was as senior psychiatrist at the U. S. Naval Hospital, Chelsea, Massachusetts. Naval medical officers retiring in May include: Rear Admiral **John Quincy Owsley**, inspector of naval medical activities, Pacific Coast Headquarters, Western Sea Frontier since 1958, after a naval career of more than 34 years; Captain **George H. Raines**, after more than 28 years in the Navy, who was serving as head of the neuropsychiatry branch, Bureau of Medicine and Surgery; Captain **Thomas M. Manley**, Naval Air Station, Minneapolis, Minnesota, after 17 years active service; Captain **Herman A. Gross**, after 30 years' service, U. S. Naval Dispensary, San Francisco; Captain **John F. Foertner**, executive officer and chief of radiology, U. S. Naval Hospital, Pensacola, Florida, after more than 22 years' service; and Captain **William R. Whiteford**, U. S. Naval Station, Long Beach, California, who will leave the Navy after more than 30 years. . . . .Colonel **James P. Pappas**, MC, USA, has been named as special assistant for combat development to the Surgeon General of the Army. He will direct the activities of the Army Medical Service combat development group, organized 6 June, which will work with other combat development agencies to assure medical support for the Army in the field. . . . . Captain **Leo J. Elsasser**, MSC, USN, chief of the Navy Medical Service Corps, recently addressed classes in hospital administration at the graduate schools of the State University of Iowa, and University of Minnesota. . . . .Drs. **Peter Starrett** and **Ward Starrett**, identical twins from Aurora, Illinois, were simultaneously commissioned first lieutenants in the Army Medical Corps Reserve, 3 May 1959. They are 1956 graduates of the University of Illinois Medical School. They are, as far as is known, the first identical twins to receive simultaneous reserve commissions in the Army. . . . .Lieutenant Colonel **Frederick W. Hastings**, MSC, USA, has been appointed assistant chief of the medical facilities branch in the office of the Surgeon General of the Army. . . . .Captain **Elmer R. King**, MC, USN, director of the department of nuclear medicine, and Commander **William McFarland**, MC, USN, clinical hematologist, U. S. Naval Hospital, Bethesda, Maryland, were among the speakers at a symposium on Acute Radiation Syndrome" 9 May. . . . .Lieutenant Commander **Eggert Petersen**, Coordi-

nator of Psychological Training, Royal Danish Navy, began a two month orientation and training visit in the United States to study the Navy's psychological program, 11 May. Commander Petersen is the second foreign naval officer invited to the United States this year to observe the Navy's work in psychology. Commander **Per Jorem**, chief psychologist of the Royal Norwegian Navy, made a similar tour in March. . . . .Lieutenant **Raymond E. George**, DC, USN, U. S. Naval Air Station, Brunswick, Maine, presented a clinic on "Cricothyroidotomy" at the meeting of the Maine State Dental Society, 19 June, in Rockland. . . . . .Captain **Raymond H. Bishop, Jr.**, MC, USA, will be the Atomic Energy Commission licensed physician operating the new radio isotope clinic at Martin Army Hospital, Fort Benning, Georgia. The Commission is expected to approve the facilities for treatment there by the end of July, which will enable the clinic to obtain radioactive isotopes and other supplies. . . . .Commander **Nell Seroka**, NC, USN, will succeed Commander **Mary J. Lindner**, NC, USN, as chief of nursing service at the U. S. Naval Hospital, Yokasuka, Japan. Commander Lindner retired 1 May, after more than 23 years of service. . . . .Major General **Jack W. Schwartz**, MC, USA, commanding officer of Tripler Army Hospital since April 1958, was recently promoted to his present rank. Prior to his assignment in Hawaii, he served at Madigan Army Hospital, Tacoma, Washington, and at Walter Reed Army Hospital. . . . .Captain **Benjamin W. Oesterling**, DC, USN, staff dental officer, Fleet Marine Force, Pacific, was a guest essayist at the 12th District Dental Society meeting at Lake Shasta, California, 9 May. . . . .Colonel **Edwin J. Pulaski**, MC, USA, chief of general surgical services at Letterman Army Hospital, San Francisco, is vice president at the First International Symposium of Anti-Infectious and Antimitotic Chemotherapy, to be held in Geneva, Switzerland, in September. The only U. S. Army physician to attend the symposium, he will represent the Army surgeon general's office. . . . . Colonel **Harold V. Ellingson**, USAF (MC), director of education and plans, U. S. Air Force School of Aviation Medicine, since 1957, succeeded Colonel **Fratis L. Duff**, USAF (MC), as commander of the Gunter Branch of the School of Aviation Medicine, Gunter Air Force Base, Alabama, on 1 July. Colonel Duff has been assigned as deputy surgeon U. S. Air Forces in Europe.

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## MEDICAL MISSILE OPERATIONS COURSE

A ten-day course in the medical aspects of missile operations will be conducted for 25 students from the military services at Patrick Air Force Base, Florida, 14-24 September 1959. The course, designed to train personnel in the field of medical and occupational health problems occurring in missile launching operations, is offered five times each fiscal year. It will be given again 9-19 November.

# Officers Certified by Specialty Boards

The surgeons general of the military medical services have announced that the following regular Medical and Dental Corps officers have been certified by the boards indicated:

### American Board of Anesthesiology

Mahan, Frank L., Capt., USAF

### American Board of Internal Medicine

Dixon, Noah M., Maj., USAF

### American Board of Oral Surgery

Albright, Cecil R., Maj., USA
Fuller, George E., Jr., Lt. Col., USA
Marlette, Robert H., Lt. Col., USA
Suitor, Paul W., Capt., USN
Wigand, Frederick T., Capt., USN

### American Board of Pathology

*Pathologic Anatomy*

Smith, Milton J., Maj., USAF

### American Board of Pediatrics

Nichols, Warren W., Capt., USAF
Taylor, Irwin T., Capt., USAF

### American Board of Peridontology

Alexander, Perry C., Lt. Comdr., USN
Raphael, Alfred L., Capt., USN

### American Board of Psychiatry and Neurology

*Neurology*

Hood, Robert F., Maj., USAF
Kruse, Francis Jr., Maj., USAF
Schwamb, Halbert H., Maj., USA
Truscott, Basil L., Capt., USA

### American Board of Radiology

Merritt, Sherman H., Capt., USAF

*Medical Nuclear Physics*

Dunnagan, William A., Capt., USAF
Hale, Carl R., Capt., USA
Merritt, Sherman H., Capt., USAF
Ross, Leonard S., Capt., USA

### American Board of Surgery

Hollingsworth, Charles E., Lt. Col., USA
Partyka, Leo C., Capt., USAF
Woosley, Homer E., Jr., Maj., USAF

*Thoracic Surgery*

Hood, Richard H., Jr., Maj., USAF
Thomas, David E., Lt. Col., USA

# A Message From the A. M. A.

This month we will consider the types of membership in the American Medical Association and the services available to members. There are five types of membership in the Association which is a federacy of constituent state and territorial medical associations with the objective of promoting the science and art of medicine and the betterment of public health.

**Active Members** are those members of constituent associations who hold the degree of Doctor of Medicine or Bachelor of Medicine and who are entitled to exercise the rights of membership in their constituent associations, including the right to vote and hold office. Active members are of two classes: dues-paying and dues-exempt. Members may be excused from the payment of dues while serving in an A. M. A. approved intern or residency training program; while temporarily in the Armed Forces; because of financial hardship; on retirement from active practice; and on reaching the age of 70.

**Associate Members** are those who hold the degree of Doctor of Medicine or Bachelor of Medicine but who are ineligible for active membership in their constituent associations because of local membership requirements.

**Affiliate Members** are those in the following categories who are nominated by the respective approving agency and elected by the A. M. A. House of Delegates: physicians who are members of chartered national medical societies of foreign countries adjacent to the United States, as well as American physicians in foreign countries engaged in medical missionary and similar educational and philanthropic work, must be approved and nominated by the A. M. A. Judicial Council; dentists who hold the degree of D. D. S. or D. M. D., who are members of state and local dental societies must be approved and nominated by the Section on Laryngology, Otology and Rhinology; pharmacists who are active members of the American Pharmaceutical Association must be approved and nominated by the Section on Experimental Medicine and Therapeutics; and teachers of medicine and allied sciences who are United States citizens and who are not eligible for membership through constituent associations must be approved and nominated by officers of a section.

**Honorary Members** are physicians of foreign countries who have risen to pre-eminence in the profession of medicine and who while attending a meeting may be elected at that meeting to such membership by the A. M. A. House of Delegates on the nomination of the Board of Trustees.

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From the Council on National Defense of the American Medical Association. The views and opinions expressed are not necessarily those of the Department of Defense. —*Editor*

Associate, affiliate, and honorary members enjoy the privileges of the Scientific Assembly without the right to vote or hold office. Such members do not pay membership dues.

**Service Members** include all regular commissioned medical officers and commissioned medical officers of the reserve components on extended active duty with the United States Army, Navy, Air Force, and Public Health Service, who have been nominated by the Surgeons General of the respective services as well as the permanent medical officers of the Veterans Administration who have been nominated by the chief medical director. All nominees must be approved by the A. M. A. Judicial Council. Service members retain membership as long as they are on active duty and thereafter, if retired, provided they do not engage in active practice. Service members do not pay dues.

The total membership of 177,000 represents 90 per cent of the nation's practicing physicians. There are 151,876 active members, of whom 10,365 have been exempted from payment of membership dues. There also are 6,170 associate, 280 affiliate, and 88 honorary members.

The service membership total is 18,875 of whom 4,686 are in the Army, 3,783 in the Navy, 3,860 in the Air Force, 1,803 in the Public Health Service, 3,832 in the Veterans Administration, and 911 military retired.

Only active and service members are eligible to acquire voting and office-holding privileges in the A. M. A.

The annual membership dues of $25 include the subscription to *The Journal of the American Medical Association* or one of the A. M. A. specialty journals and the *AMA News,* the biweekly newspaper of American medicine. Dues will be remitted 1 January or 1 July following the date of entry on active military duty to all members of the Armed Forces and the United States Public Health Service, irrespective of exemptions for local dues.

While only dues-paying members receive complimentary copies of the specialty journals, the *AMA News* is sent gratis to all Association members regardless of type of membership. However, the *J. A. M. A.* and some of the specialty journals are available to service members at most military, Public Health Service, and Veterans Administration hospitals. Moreover, A. M. A. publications are available on individual subscription by service members.

The following are some of the many benefits of membership in the American Medical Association: (1) Participation in two huge postgraduate meetings annually where leading medical men report on medical advances, show scientific exhibits, newest films, and medical TV; (2) Personalized information services on new drugs, therapy and research, foods and nutrition, physical

medicine, cosmetics, pesticides, poisons, and medical quackery; (3) Individualized library reference and medical periodical lending services; (4) Research project opportunities and small grants; (5) Personalized information services on socioeconomic medicine, medical legislation and medicolegal problems; (6) Physican-placement service and counseling on practice management problems; (7) Educational material for patients; (8) Representation to the Congress of the United States; and (9) Question-and-answer consultation service conducted by medical experts via *J. A. M. A.*

In addition, the following personal services are available to all members on request: information about physicians' income tax returns; doctor-placement help; data about a specific drug or class of drugs; standardized insurance claim forms; practice management information; physician-hospital relationship guidance; bibliographies and information on various forms of medical practice; guides for evaluating indigent care plans; latest findings on nutrition in pregnancy or fat in the diet in relation to disease; a run-down on a suspected medical charlatan; a list of internships and residencies offered annually; a set of medicolegal forms for your practice; health education literature for your patients; a guide to physician participation in radio and TV broadcasts; a list of postgraduate courses offered to physicians around the nation; information on the medical aspects of alcoholism and drug addiction; data on workmen's compensation laws; and prompt help with nearly every problem you encounter in your practice.

All members of the Association are encouraged to avail themselves of the benefits and services of membership. When in Chicago, all members are invited to visit the Association's headquarters.

## DEATHS

VEIGEL, Lester Paul, Colonel, USAF (MC), of Winter Park, Fla.; assigned as surgeon of Western Air Defense Force, Hamilton Air Force Base, Calif.; graduated in 1931 from Northwestern University Medical School, Chicago, Ill.; appointed a first lieutenant in the Army of the United States 4 November 1932; reported for active duty 10 December 1932; commissioned a first lieutenant in the United States Army on 1 July 1933; transferred to the United States Air Force on 22 July 1949; died 3 June 1959, aged 54, Hamilton Air Force Base, of coronary arteriosclerosis.

ZUCKER, Joseph Stanley, Second Lieutenant, AFRes (MSC), of Springfield, Ohio; assigned to 3575th U. S. Air Force Hospital, Vance Air Force Base, Okla.; graduated in 1952 from Ohio State University; appointed a second lieutenant in the United States Air Force Reserve on 30 June 1956, reported for active duty 23 October 1958; died 25 March 1959, aged 29, near Morrilton, Ark., as a result of a military aircraft accident.

# Book Reviews

LONG-TERM ILLNESS - MANAGEMENT OF THE CHRONICALLY ILL PATIENT, edited by *Michael G. Wohl*, M. D., with 79 contributors. 748 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa. 1959. Price $17.

The authors propose to present in one volume a "comprehensive survey" of the management of individuals afflicted with prolonged illness. This is admirable and is part of the goal and achievement of the several established textbooks of medicine; the remaining part being the management of acute and, if properly diagnosed and effectively treated, transient illness. The book is divided into two parts. The first is devoted to organizational, institutional, community-resource matters on both the small and grand scale. As epitomized by the Veterans Administration rehabilitation centers and obtainable only by means of the massive financial support of the Federal Government, the grand scale concept must remain a dream for all but a few individuals in a few communities. On the small scale the home is the *locus regimenti* to which the physician is urged to bring faith, hope, charity, optimism and sandbags for progressive resistance exercises. It exhorts physicians to have understanding and encouragement for those whom they cannot as yet cure. The style in much of this portion is crusading, which is irritating to this reader, as it attempts to generate an attitude that can be assumed on the part of any qualified reader of the book and thus wastes time and space better devoted to the practicalities of rehabilitation. One feels that the authors display an element of rationalization here for the title they have chosen. To pass to the second portion of the book, which represents 85 per cent of the volume is refreshing. That the nervous afflictions are given generally more scanty treatment and only slightly more space than the endocrine system, that orthopedics, exclusive of a superb chapter on medical therapy of rheumatic disorders and gout, is contained in 28 pages and osteoarthritis dismissed on one half-page of a 705-page volume will surprise many. The coverage of the material in the book is uneven; and taking that which is felt to be justifiably included as our yardstick, it is difficult to justify the omission of so many equally prevalent or more prevalent diseases. For example, leprosy is given 5 pages, while malaria and a host of prevalent chronic, albeit tropical, diseases are omitted altogether. Typhoid and its carrier problem are not mentioned. Rheumatic and congenital heart disease in which such strides have recently been made are covered in 16 pages, and not a phrase is devoted to the problem raised by reprieve from sentence of invalidism and early death. This book contains a few very well done essays, but much that is unrewarding to the reader. The bibliography is current and adequate in some chapters, but in others consists only of the mechanical listing of the authors' previous publications.—*ROBERT E. DeFOREST, Lt., MC, USN*

STAPHYLOCOCCUS PYOGENES and its Relation to Disease, by *Stephen D. Elek,* M. D., D. Sc., Ph. D., D. P. H. 767 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., 1959. Price $15.

The publication of this volume, classified by the author as a monograph, is indeed timely; for both clinicians and microbiologists a wealth of information is provided. The text is divided into 15 chapters, progressing from a historical survey through various qualities and characteristics of staphylococci, and finally presenting clinical problems of staphylococcal infection. In addition to a subject index and an authors' index, there is an extensive bibliography of excellent references for source material. This volume is well organized, the text is clearly presented and is effectively illustrated with tables, figures, photographs, and reproductions of electronmicrographs. The book is attractively bound and the contents provide easy reading; there are a few, though minimal, errors in typography and composition. Although there may be those who would disagree with some of the statements and philosophies of the author, such a possibility should not detract from the value of the book. This volume is highly recommended for reading and reference by clinicians, researchers, microbiologists, and others who need to be well-informed in the many aspects of the current world-wide problems of staphylococcal disease.

—*LAVERNE A. BARNES, Capt., MSC, USN*

PRELIMINARY RESULTS OF SCIENTIFIC RESEARCHES ON THE FIRST SOVIET ARTIFICIAL SATELLITES AND ROCKETS. Compilation of Studies Performed during the international geophysical year, 1957-1958. Academy of Sciences of the USSR, Moscow, Russia, 1959.

This recent volume presents some of the Russian contributions in space research to the program of the International Geophysical Year. It contains three articles written in Russian, but with brief English summaries. Of major interest is "Medico-biological Studies on Rockets" which comprises one third of the book. The Soviet animal capsules and their methods for the utilization of oxygen and the removal of carbon dioxide are described. There is a discussion of the photography and reactions of the test animals in rocket flight of 100 to 212 kilometers, including the effects of acceleration and weightlessness. The time of the flights varied from 50 to 60 minutes, during which the animals were subjected to weightlessness for periods ranging to 3.7 minutes. Complete or partial periods of weightlessness produced lowering of arterial pressure and decreased pulse rates. No changes were observed in behavior or in the physiologic functions of the animals, nor in the pigmentation of the skin or fur, which could be considered to be due to cosmic radiation during the flight. Examination of the animals for a period of from 6 to 7 months after the flight was negative from the standpoint of changes in health and behavior. Several of the chapters are well documented and contain many references, several of which are of American origin.

—*PAUL A. CAMPBELL, Col., USAF (MC)*

VASCULAR SURGERY, by *Geza de Takats,* M. D., M. S., F. A. C. A. 726 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $17.50.

In the preface of this volume Dr. de Takats states that "in the areas where technical advances are most frequent there is the greatest need for a statement of fundamental principles. There must remain a home base; a foundation of basic facts, which do not change even though their interpretation may have to be modified from time to time." In this monograph, he presents succinctly and accurately the basic facts of vascular surgery, but "there is no cardiac or cardiothoracic subject discussed unless it bears on peripheral circulation." The volume is divided in four parts: Fundamental Principles Affecting Vascular Surgery; Methods of Diagnosis; Vascular Syndromes Requiring Surgical Care; and Surgical Technique. Each section is complete with cross indexes to other sections and voluminous references. For the practitioner or student of vascular surgery the volume is replete with the knowledge and technics of this preeminent specialist in the field, and is highly recommended for reading and reference.

*—FELIX P. BALLENGER, Capt., (MC) USN*

THE YEAR BOOK OF OPHTHALMOLOGY (1958-1959 Year Book Series), edited by *Derrick Vail,* B. A., M. D., D. Oph. (Oxon), F. A. C. S., F. R. C. S. (Hon.) 407 pages; illustrated. The Year Book Publishers Inc., Chicago, Ill., 1959. Price $7.50.

The current volume of this series is as valuable as its predecessors. It serves as a quick and ready reference source for the busy ophthalmologist. The material is again divided in a logical arrangement. This review of articles in the world's ophthalmic literature is made even more valuable by the terse, accurate and occasionally humorous comments by its editor, Dr. Vail. This volume contains a good special article on recent advances in the diagnosis and medical therapy of chronic simple glaucoma by Dr. Bernard Becker. Illustrations are not profuse but are well selected and adequate. The volume is well indexed. Ophthalmologists who have purchased this book in past years will find the present volume fully up to the standards set by its predpcessors.—*VICTOR A. BYRNES, Brig. Gen., USAF (MC)*

SELF-DESTRUCTION. A Study of the Suicidal Impulse, by *Beulah Chamberlain Bosselman,* M. D. 94 pages. Charles C Thomas, Publisher, Springfield, Ill., 1958. Price $4.75.

The social and emotional background of self-destruction is examined in less than 100 pages. This is well done but the pallid series of case histories seem to miss the point. Dr. Bosselman is content to illuminate the dark places where suicide is found and makes no attempt to discuss the more controversial treatment aspects, except to give the impression that psychotherapeutic measures are the only ones. Pages 16 through 20 contain short, appealing outlines of various family situations and their long-term emotional effects. These

four pages of psychologic leavening are worth looking up and reading during the next trip to the library. The book is recommended to those with a special interest in suicide as a medical or social problem.

—*PAUL F. EGGERTSEN, Lt. Col., USAF (MC)*

PHYSIOLOGY OF MUSCULAR ACTIVITY, by *Peter V. Karpovich*, M. D., M. P. E., originally by *Edward C. Schneider*, M. P. E., Ph. D., D. Sc. 5th edition. 368 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $5.

This fifth edition of a book well-known to everyone engaged in teaching and research of physical education and physiology of exercise, is the first to be published since the original author's death in 1954. Dr. Karpovich has made new valuable contributions to the book. The physiologic phenomena during physical activity are thoroughly discussed in twenty-one chapters and the reader is given much information on such topics as energy cost of various activities; fatigue and staleness; health, physical fitness and age; physical work in relation to external temperature; and ergogenic aids in work and sports. Although more than 500 original reports of experimental research have have been incorporated in the text, many of the conclusions and statements carry his very personal note. This is natural in such a field research, and is stimulating for an exchange of thoughts. In some instances, however, our knowledge has progressed further than presented in this book. Generally, the text, as well as many fine illustrations and tables, reveal an abundance of interesting material. The book offers not only guidance for the biological thinking of instructors and students in physical education but of medical students, medical practitioners and specialists, and of medical service officers as well.

—*BRUNO BALKE, M. D.*

A PRACTICE OF THORACIC SURGERY, by *A. L. d'Abreau*, O. B. E., Ch. M., F. R. C. S. 2d edition. 619 pages; illustrated. The Williams & Wilkins Company, Baltimore, Md., 1959. Price $19.

The second edition of this textbook is more comprehensive than the edition published in 1953. It is divided into seven major sections ranging from anatomic and physiologic considerations to thoracoabdominal surgery. The material presented is aimed to acquaint the reader with the current practices in thoracic and cardiac surgery. The author is to be complimented for illustrations of the technic of postural drainage which is not generally appreciated. The section devoted to pyogenic infections is clearly written in such a manner as to facilitate appreciation of current concepts regarding lung abcess and bronchiectasis. The surgical aspects of tuberculosis are outlined and the discussion of both resection and collapse theory is sound. The discussion of pulmonary malignancy is concise and the appraisal of treatment results is presented frankly. The discussion allotted to congenital heart diseases follows the general pattern; however, those sections dealing with angiocardiography and cardiac catheterization are clearly presented for ready understanding by the surgeon.

The author has coupled an extensive personal experience with that of numerous colleagues to present a comprehensive picture of thoracic surgery. The book has value as a reference particularly in presenting the broad scope of this surgical specialty. It is of limited value to the student embarking on a career in thoracic surgery.

—*THOMAS H. HEWLETT, Lt. Col., MC, USA*

DENTAL CLINICS OF NORTH AMERICA, Symposium on Crown and Bridge Prosthodontics. Consulting editor, *Vincent R. Trappozzano,* D. D. S. 277 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $16.

This book contains a group of excellent presentations, each appearing as a complete chapter, by competent and interested instructors and clinicians in the field of crown and bridge prosthodontics. The early chapters deal with careful, accurate, diagnostic methods of selecting restorations and retainers. Included are complete descriptions of technics and avenues of mouth preparation with which to establish a firm, healthy basis on which a restoration may be placed to afford a prognosis of a long and satisfactory service to the patient. Other chapters cover technical operations involved in the attainment of completed restorations. Both the clinical and laboratory procedures are clearly portrayed. The use of co-medications in dentistry, and the psychology of dealing with individuals receiving restorations, are offered concisely as an adjunct in successful treatment of endentulous areas. This text will prove an asset to dental practitioners who are seeking step by step descriptions of clinical and laboratory procedures in crown and bridge prosthodontics.

—*HARRY H. FRIDLEY, Capt., DC, USN*

BONE TUMORS, 2d edition, by *Louis Lichtenstein,* M. D. 402 pages; illustrated. The C. V. Mosby Company, St. Louis, Mo., 1959. Price $12.

The second edition of one of the most enlightening and comprehensive texts on bone tumors to be published presents a timely review of the author's concepts and extensive experience in this field. The purpose of this volume is to convey a practical working knowledge of bone tumors, emphasizing accurate diagnosis and therapeutic technics. This has been achieved with brevity and clarity. Since publication of the first edition in 1952, the author has added valuable material in support of his views. The introductory chapters contain helpful remarks concerning clinical management and x-ray interpretation. The classification of primary bone tumors has been generally confused, especially since conclusions are based on factors other than etiology. The usual basis for classification has been the predominant cell or tissue as seen in large sections of bone. The author's classification is simple and concise and offers a helpful working hypothesis. Well organized chapters describe the specific types of tumors, most of the space being devoted to the sarcomas, the osteoclastoma, and the multiple myeloma. There are 220 illustrations; the roentgenograms are clear and instructive and the gross specimens and photomicrographs of good quality. The latter would have been better in color.

A useful bibliography is found at the end of each chapter. There are two valuable appendices for ready reference, the first to nonneoplastic lesions of bone which may be mistaken for tumors and the second to tumors of synovial joints, bursae, and tendon sheaths. The author emphasizes a close working relationship among the clinician, radiologist, and pathologist to establish an accurate diagnosis and prognosis. He warns against the overdiagnosing of lesions and consequent overtreatment. Support is offered for the controversial benign chondroblastoma and chondromyxoid fibroma which may be mistaken for a malignant chondrosarcoma. This book is highly recommended and should be available to every physician who deals with neoplasms of bone.— *EARL W. BRANNON, Col., USAF (MC)*

MANUAL OF DIFFERENTIAL DIAGNOSIS, by *William C. Matousek*, M. D. 352 pages. The Year Book Publishers, Inc., Chicago, Ill. Price $8.

This is another book concerned with differential diagnosis in which the author has attempted to present an integrated differential diagnosis of selected symptoms and signs in telegraphic style. The book comprises 352 pages and contains no illustrations. Symptoms are listed alphabetically in the table of contents, beginning with abdominal distention and concluding with weakness. Each discussion begins with a table of the causes of the symptom by its various mechanisms of production. A brief review of pertinent facts relative to each mechanism and its mode of approach from a diagnostic viewpoint follows. An addendum concludes each discussion with generalities to be considered in the over-all approach. With few exceptions, a carefully selected reference for further details is found at the end of each symptom review. The book is well written, easy to read, and should find favor among senior medical students, internes and busy general practitioners. It is not recommended for the specialist who would glean little from its contents except for review of basic approaches as it is impossible for such a text to be totally complete in its approach and an occasional omission is to be expected.

—*JULES J. McNERNEY, Lt. Col., MC, USA*

UROLOGY IN OUTLINE, by *T. L. Chapman*, Ch. M., F. R. C. S., F. R. F. P. S. 176 pages; illustrated. The Williams & Wilkins Company, Baltimore, Md. 1959. Price $6.75.

The author defines his presentation as being unorthodox inasmuch as he relies on drawings or "images" to elaborate on the text. Each chapter has a brief introductory written discussion, which is then illustrated by drawings in sequence to illustrate the various stages in pathogenesis as well as the main features in treatment. The effect is that of a vivid picture of the basic features of all aspects of urology. Clear illustrations in the chapters on renal function and neurogenic bladder crystallize the complex matter into a clear and understandable basic picture. The book is not intended for the specialist but rather for the general practitioner, student, technician; or as a primer for those entering the specialty. In this capacity it fulfills its purpose well.— *ALBIN A. GALUSZKA, Capt., MC, USN*

# New Books

Books received by the *U. S. Armed Forces Medical Journal* are listed in this department for the information of readers, and as acknowledgement and appreciation of their receipt from the publishers. Those of greatest interest will be selected for review in a subsequent number of the *Journal.*

SURGERY OF THE EAR, by *George E. Shambaugh, Jr.,* M. D. 669 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $27.50.

PANCREATITIS, A Clinical-Pathologic Correlation, by *Herman T. Blumenthal,* Ph. D., M. D., and *J. G. Probstein,* M. D., with a foreword by *R. M. Zollinger,* M. D. 379 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $9.50.

YOUR MIND CAN MAKE YOU SICK OR WELL, by *Curt S. Wachtel,* M. D. 244 pages. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1959. Price $4.95.

THE BIOCHEMISTRY OF CLINICAL MEDICINE, by *William S. Hoffman,* Ph. D., M. D., F. A. C. P. 2d ed. 734 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1959. Price $12.

HANDBOOK OF TOXIOLOGY, Vol. III: Insecticides. A compendium by *William O. Negherbon,* prepared under the direction of the Committee on the Handbook of Biological Data, Division of Biology and Agriculture, The National Academy of Sciences, The National Research Council. 854 pages. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $14.

HANDBOOK OF TOXIOLOGY, Vol. IV: Tranquilizers. Analysis and compilation by *Maxwell Gordon* and *R. F. McCandless,* with the technical assistance of *S. W. Lipman.* Edited by *Rudolph M. Grebe.* Prepared under the direction of the Committee on the Handbook of Biological Data, Division of Biology and Agriculture, The National Academy of Sciences, The National Research Council. 120 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $4.

HANDBOOK OF TOXIOLOGY, Vol. V: Fungicides. Analysis and compilation by *Everett F. Davis, Barbara L. Tuma,* and *Lucy C. Lee.* Edited by *Dorothy S. Dittmer.* Prepared under the direction of the Committee on the Handbook of Biological Data, Division of Biology and Agriculture, The National Academy of Sciences, The National Research Council. 242 pages. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $5.50.

CORRECTIVE PHYSICAL EDUCATION, by *Josephine Langsworth Rathbone,* Ph. D. 6th edition. 329 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $5.

UROLOGICAL NURSING, by *David M. Davis,* M. D., and *Kenneth C. Warren,* M. D. 6th edition. 196 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $3.75.

FUNDAMENTALS IN NURSING CARE, by *Mildred L. Montag,* Ed. D., R. N., and *Ruth P. Stewart Swenson,* M. A., R. N. 3d edition. 581 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $5.

THE FUNCTIONS OF THE ENDOCRINE GLANDS, by *Peter F. Hall,* M. D., M. R. C. P., M. R. A. C. P. 290 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $5.75.

THERAPEUTIC ELECTRICITY AND ULTRAVIOLET RADIATION, Volume 4 of Physical Medicine Library. Edited by *Sidney Licht,* M. D. 373 pages; illustrated. Elizabeth Licht, Publisher, New Haven, Conn., 1959. Price $10.

PATHOLOGY, by *Peter A. Herbut,* M. D. 2d edition. 1516 pages; illustrated. Lea & Febiger, Philadelphia, Pa., 1959. Price $18.50.

TREATMENT OF CANCER AND ALLIED DISEASES, Volume III, edited by *George T. Pack,* M. D., F. A. C. S., and *Irving M. Ariel,* M. D., F. A. C. S. 2d edition. Seventy authors. 781 pages; illustrated. Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, New York, N. Y., 1959. Price $30.

PEDIATRIC CLINICS OF NORTH AMERICA, May 1959. Symposium on Neoplastic Diseases. Vol. 6, No. 2. *James B. Arey,* M. D., Consulting Editor. 317 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $15 per set of 4 books issued quarterly.

A TEXTBOOK OF PHARMACOLOGY AND THERAPEUTICS, Including Drugs and Solutions, by *Harold N. Wright,* M. S., Ph. D., and *Mildred Montag,* Ed. D., R. N., with an appendix on Canadian Drug Legislation by *Charles W. Nash,* B. Sc., Ph. D. 7th edition. 497 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $5.

ELECTRONS, ELEMENTS AND COMPOUNDS, by *Eric Hutchinson,* Ph. D. 552 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $6.

PRINCIPLES OF MICROBIOLOGY, by *Walter W. Krueger* and *Karl R. Johansson.* 2d edition. 563 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $6.75.

MEDICAL AND SURGICAL NURSING II, by *Amy Frances Brown,* R. N., B. Ed., M. S. in N., Ph. D. 850 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $8.

A TEXTBOOK OF MEDICINE, edited by *Russell L. Cecil,* M. D., Sc. D., and *Robert F. Loeb,* M. D., Sc. D., D. Hon. Causa, LL. D. 10th edition. 1,665 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $16.50.

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES, Volume 74, Article 3, pages 407-1028, March 30, 1959. Editor-in-chief, *Otto v. St. Whitelock.* "Chlorpropamide and Diabetes Mellitus." 621 pages; illustrated. The New York Academy of Sciences, New York, N. Y., 1959. Price $5.

THE YEAR BOOK OF DERMATOLOGY AND SYPHILOLOGY (1958-1959 Series), edited by *Rudolph L. Baer,* M. D., and *Victor H. Witten,* M. D. The Year Book Publishers, Inc., Chicago, Ill., 1959. Price $8.50.

THE YEAR BOOK OF NEUROLOGY, PSYCHIATRY AND NEUROSURGERY (1958-1959 Year Book Series). Neurology, edited by *Roland P. Mackay,* M. D. Psychiatry, edited by *S. Bernard Wortis,* M. D. Neurosurgery, edited by *Oscar Sugar,* M. D. 623 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1959. Price $8.50.

PATIENT CARE AND SPECIAL PROCEDURES IN X-RAY TECHNOLOGY, by *Carol Hocking Vennes,* R. N., B. S., and *John C. Watson,* R. T. 203 pages; illustrated. The C. V. Mosby Company, St. Louis, Mo., 1959. Price $5.75.

STRONG AND ELWYN'S HUMAN NEUROANATOMY, by *Raymond C. Truex.* 4th edition. 511 pages; illustrated. The Williams & Wilkins Company, Baltimore, Md., 1959. Price $10.

A MANUAL OF ANAESTHETIC TECHNIQUES, by *William J. Pryor,* M. D., Ch. B. (N. Z.), F. F. A. R. C. S. (Eng.), D. A. (Eng.), F. F. A. R. A. C. S., with a foreword by *J. H. T. Challis,* M. R. C. S. (Eng.), L. R. C. P. (Lond.), F. F. A. R. C. S. (Eng.), D. A. (Eng.). 2d edition. 228 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., 1959. Price $7.

GENETICS, RADIOBIOLOGY AND RADIOLOGY PROCEEDINGS, Mid-Western Conference, by *Wendall G. Scott,* M. D., Chairman, and *Titus Evans,* Ph. D., Co-Chairman. 149 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $5.50.

PHYSIOLOGY OF CARDIAC SURGERY, Hypothermia, Extracorporeal Circulation and Extracorporeal Cooling, by *Frank Gollan,* M. D. 96 pages. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $4.50.

THE INNERVATION OF MUSCLE, A Biopsy Study, by *C. Coers,* M. D., and *A. L. Woolf,* M. D. 149 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $9.

BRONCHOGRAPHY, by *C. Dijkstra,* M. D. 157 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $9.50.

CLINICAL NEUROPHYSIOLOGY, by *John Marshall,* M. D., F. R. C. P. (Ed.), M. R. C. P., D. P. M. (Lond.). 292 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $8.

HIGH ALTITUDE AND SATELLITE ROCKETS, A Symposium sponsored by The Royal Aeronautical Society, The British Interplanetary Society and The College of Aeronautics held at Cranfield, England, 18-20 July 1957. 136 pages; illustrated. The Philosophical Library, Inc., New York, N. Y., 1959. Price $15.

ALLERGIC ENCEPHALOMYELITIS, Proceedings of a Symposium: Experimental "Allergic" Encephalomyelitis and its Relation to Other Diseases of Man and Animal, edited by *Marian W. Kies,* Ph. D., and *Ellsworth C. Alvord, Jr.,* M. D. 576 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $13.50.

PATHOLOGIC PHYSIOLOGY OF ORAL DISEASE, by *Richard W. Tiecke,* B. S., D. D. S., M. S., F. A. C. D.; *Orion H. Stuteville,* B. S., D. D. S., M. D. S., M. D.; and *Joseph D. Calandra,* M. D., Ph. D. 480 pages; illustrated. The C. V. Mosby Company, St. Louis, Mo., 1959. Price $11.50.

HIGH SPEED AND ULTRA SPEED IN DENTISTRY, Equipment and Procedures, by *Harold C. Kilpatrick,* D. D. S. 289 pages; illustrated. W. B. Saunders Company, Philadelphia, Pa., 1959. Price $8.50.

INTRA VASCULAR CATHETERIZATION, compiled and edited by *Henry A. Zimmerman,* M. D., B. S., with twenty-three contributors. 782 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $16.75.

PROGRESSIVE EXERCISE THERAPY IN REHABILITATION AND PHYSICAL EDUCATION, by *John H. C. Colson,* F. C. S. P., M. S. R. G., M. A. O. T., with a foreword by *J. M. P. Clark,* M. B. E., M. B. 184 pages; illustrated. The Williams & Wilkins Company, Baltimore, Md., 1959. Price $4.50.

PSYCHIATRY IN MEDICAL PRACTICE, by *W. Lindesay Neustatter,* M. D., B. Sc. (Psy.), M. R. C. P. 311 pages. John de Graff, Inc., New York, N. Y., 1959. Price $8.

INTERNATIONAL TEXTBOOK OF ALLERGY, edited by *J. M. Jamar,* M. D. 639 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $17.50.

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